Spheno maxillary
Sphenoid at foramen
Spheno maxillary
pterygo-maxillary fissure
not under ⊕
Spheno palatine
post. palatine canal
accessory post palatine
pterygo palatine
Vidian
Vesalii

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OSTEOLOGY

AND

SYNDESMOLOGY

BY

HOWARD A. SUTTON, A. B., M. D.

Assistant in the Department of Anatomy of the University of Pennsylvania, Lecturer
in Anatomy Pennsylvania Orthopedic Institute, Assistant
Surgeon Methodist Episcopal Hospital, &c.

AND

CECIL K. DRINKER, B. S.

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Dedicated

TO

DR. GEORGE A. PIERSOL

IN APPRECIATION OF HIS
SURPASSING ABILITY AND TIRELESS ENERGY AS A
TEACHER OF ANATOMY, AND HIS
SYMPATHY WITH ALL EFFORTS TO PROMOTE
THE ADVANCEMENT
OF MEDICAL EDUCATION

PREFACE

JUST as anatomy is the foundation of medicine, so osteology is the foundation of anatomy. Universally it is the first work given the new student, and with almost equal universality he finds it difficult. He meets a myriad of new terms gathered from all parts of general anatomy, and he must build these on and through the skeleton as he masters its details. Muscles and ligaments must be correllated with the bones to which they attach. Nerves and vessels must be learned in relation to the bones they mark.

To secure such a result the student must study from a large anatomy, passing from the section on bones to that upon muscles and so on as far as his thoroughness will carry him. It is the hope of the authors that in presenting this small volume they remove the need for such tedious labor.

The bones follow one another in the order found simplest and most useful in presenting the course in osteology at the University of Pennsylvania. Summaries occur at the end of every section, which is not a summary in itself. It is hoped they will facilitate review and will be of service in the quizzing of the student with his fellows—a method of work most necessary in such a course.

Each joint is discussed after the bones which compose it, instead of in a separate division at the end of the book. In this way they will be found to be practically review instead of new matter.

In the preparation of the text the authors have consulted Morris's, Piersol's, Gray's, Cunningham's, and Swan's Anatomies, and acknowledge their indebtedness to them.

PHILADELPHIA, Sept. 22d, 1910.

H. A. S.
C. K. D.

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THE FOLLOWING SIMPLE ABBREVIATIONS ARE USED IN THIS WORK:

Ant., anterior.
A., artery.
E. g., for example.
Ext., external.
Inf., inferior.
Int., internal.
Lat., lateral.
L., left.
Lig't., ligament.
M., muscle or muscles.
N., nerve.
Post., posterior.
R., right.
Sup., superior.

OSTEOLOGY AND SYNDESMOLOGY

SECTION I.

DESCRIPTIVE TERMS

To approach intelligently a subject so precise as Osteology, the student must first of all acquaint himself with certain principles of anatomical description.

The normal position of the human body is upright, with hands at sides and palms forward.

THREE CHIEF PLANES DIVIDE THE BODY:

1. **Sagittal:**—Passes perpendicularly through the body at right angles to the Ant. surface. It need not necessarily be central, but when so, it bisects the Ant. and Post. body surfaces.

2. **Transverse:**—Passes horizontally through the body, at right angles to the sagittal plane and the long axis.

3. **Frontal or Coronal:**—Passes perpendicularly through the body, parallel to the Ant. and Post. body surfaces, and at right angles to the sagittal and transverse planes.

The terms "superior" and "inferior" indicate position toward, or away from the head end of the body. "Anterior" and "posterior" refer to the front and back of the body; "ventral" and "dorsal" are more modern equivalent terms. "Internal" and "external" refer to relations with the sagittal plane of the body; "inner" and "outer," "mesial" and "lateral," are synonymous.

Other terms applied particularly to bones are:—

Condyle, a rounded articular eminence. Always found in pairs.

Crest, a prominent border.

Facet, a small, limited surface.

Fissure, a narrow cleft.

Foramen, a perforating hole.

Fossa, a concavity.

Head, a rounded, partly articular enlargement upon the end of a bone.

Neck, a constricted area immediately below the head.

Process, a projection.

Recent state, applied to bones with relation to normal neighboring parts.

Ridge, a narrow, rough elevation running along the surface.

Shaft, that portion of a long bone between the extremities, excluding the neck.

Spine, a sharp projection.

Sinus, a groove, hollow, or pocket. In the skull it is applied to the venous blood channels. The word has many other applications of no significance in osteology.

Styloid process, a pointed projection.

Sulcus, a furrow.

Trochlear surface, a process having the nature of a pulley.

Tubercle, a small, rough eminence.

Tuberosity, a large, uneven eminence.

STRUCTURE AND DEVELOPMENT OF BONE

STRUCTURE

Bone is merely a modified form of connective tissue. It consists of 33.3% organic matter, and 66.7% inorganic matter.

On making a cross section of a typical long bone certain gross characteristics are noticed. With the exception of articular areas, the bone is intimately enclosed in a fibrous envelope, the **Periosteum,** essential to growth and nourishment, and showing two layers under the microscope:—

1. Outer, fibrous.
2. Inner, fibro-elastic.

In growing bones the inner layer furnishes large numbers of connective tissue cells (Osteogenetic layer).

Beneath the Periosteum, a long bone presents two structural types of bone, encircling a Central Marrow Cavity.

I. COMPACT BONE

Composed of three kinds of lamellae or layers.

A. **Circumferential:**—Encircle the bone lying parallel to the surface, immediately beneath the Periosteum.

B. **Haversian:**—Smaller cylinders of bone concentrically disposed about a minute foramen, the Haversian Canal.

C. **Interstitial:**—Fill in the spaces between the circumferential and Haversian lamellae. They represent the remains of the original spongy bone.

Passing perpendicularly to the surface of the bone through the circumferential, and, to some extent, through the interstitial lamellae, are found the **Perforating Fibres of Sharpey.**

The next essential in the structure of compact bone is the **Haversian System,** made up as follows:

1. **Haversian Lamellae.**
2. **Haversian Canal,** a central foramen, enclosing blood vessels and often marrow tissue. It communicates internally with the central marrow cavity.
3. **Lacunae,** minute spaces between the lamellae, enclosing the stellate bone cells.
4. **Canaliculi,** microscopic lymph channels, radiating in every direction from the lacunae.

Lacunae and canaliculi are found in all types of bone.

II. CANCELLATED, OR SPONGY BONE

Genetically this is always the first form of bone. It is composed of delicate strands of osseous tissue arranged so as to give the bone its maximum of strength.

Bone Marrow

All spaces in bone, not occupied by blood vessels, lymphatics, or nerves, are filled with a mixed connective tissue called marrow. There are two varieties,—red and yellow.

Red Marrow

A definite reticulum supports the many cells and blood vessels found in this variety.

Cells of Red Marrow:—

1. **Myelocytes,** or marrow cells proper.
2. **Eosinophile** cells.
   - A. Mononuclear.
   - B. Transitional.
   - C. Polymorphonuclear.
3. **Myeloplaxes,** or giant cells.

Specialized myelocytes are called, when engaged in bone absorption, osteoclasts.

4. **Red blood** cells.
   - A. Erythroblasts (Nucleated).
   - B. Normoblasts (Nucleated).
   - C. Erythrocytes (Non-nucleated).

Yellow Marrow

This is merely red marrow in which fat cells have replaced the other elements.

Blood Supply of Bone

Accomplished by two sets of vessels.

1. **Periosteal:**—Minute twigs passing from the periosteum through **Volkmann's Canals** into the bone, where they anastomose with the Haversian Capillaries

2. **Medullary:**—The medullary artery enters the central marrow cavity of the bone through the nutrient foramen, and breaks into numerous branches which enter the Haversian Canals. Blood is carried away by the Venae Comites of the nutrient artery, and by independent veins passing out of foramina in the end of the bone.

DEVELOPMENT

In the foetal state, hyaline cartilage maps out all the bones except those of the vault of the cranium, the face, and part of the lower jaw. Bone *in no case* is developed from this primary cartilage, but by the substitution and action of special bone cells.

Two methods act simultaneously to produce a long bone, (1) **Endochondral**, and (2) **Periosteal.**

1. **Endochondral Bone Formation:**—This occurs within a cartilaginous medium and proceeds by the following steps:

a. At points near the middle of the future shaft, the cartilage cells enlarge and become rearranged in vertical rows. Such points are known as Centres of Ossification. Between the columns of cells, trabeculae are formed by means of calcareous deposit.

b. Simultaneously, from the osteogenetic layer of the periosteum, a thin layer of true bone has been formed. Through this, processes of the periosteum grow inward toward the centre of ossification. Absorbing the cartilage as they go, these processes finally break into the enlarged cartilage lacunae at the centre of ossification, and cause them to communicate, thus forming the Primary Marrow Cavity. The primary marrow fills this cavity.

c. The primary marrow cavity enlarges. The cartilage cells disappear. Upon the calcareous trabeculae between these cells, certain marrow cells, which have become osteoblasts, lay down a covering of true bone. At the same time the trabeculae are gradually absorbed.

The osteoblasts soon encase themselves in bone, thus forming their own lacunae, and becoming bone cells. With the constant laying down of bone a network is formed, known as the Central Primary Spongy Bone.

d. The above process extends toward the extremities. Simultaneously, osteoclasts begin to absorb it, and form the central marrow cavity of the bone. As they absorb, they form depressions called Howship's Lacunae.

2. **Periosteal Bone Formation**:—Simultaneously, processes from the periosteum passing everywhere beneath the periphery of the bone, undergo transformation into osseous trabeculae. A network of spongy bone is thus formed, enclosing the central spongy bone and the beginning of the central marrow cavity, or medullary space.

In the cavities of the spongy bone are imprisoned cells which have come from the periosteum. These develop into osteoclasts and osteoblasts. The former appear first and absorb the partitions between the spaces in which they have been enclosed, forming large regular cavities. Inside these cavities the osteoblasts now deposit layers of bone, until only a small central canal is left. Thus is compact bone developed from spongy. Bone developing in this way grows longitudinally and toward the periphery.

Intramembranous Bone Formation:—Accounts for development of the bones of the cranium and lower jaw. Instead of a primary cartilaginous condition, connective tissue only is present. From centres in this tissue, radial trabeculae appear. Ossification occurs along these, a network of bone being produced. This network is not closed by the formation of Haversian systems, but by the continued growth of the trabeculae until plates of bone are formed. Bone developing in this way grows by simple extension.

KINDS, NUMBER AND ARRANGEMENT OF BONES

KINDS

1. **Long bones:**—Each consists of a lengthened cylindrical shaft, bearing two enlarged extremities, to some extent articular:—e. g., The Humerus.

2. **Flat bones:**—Composed occasionally of a single thin plate of compact bone. Usually consist of two layers of compact bone, enclosing cancellated bone of varying thickness:—e. g., Scapula.

3. **Irregular bones:**—Embrace all others:—e. g., Vertebra.

Sesamoid bones are not part of the true skeleton. They develop in tendons where friction necessitates a hard surface. Wormian bones occur in the path of a serrated suture, and are merely fragments of the articulating bones.

NUMBER

The Spine, including Sacrum and Coccyx	26
Cranium	8
Face	14
Hyoid, Sternum and Ribs	26
Upper extremities	64
Lower extremities	62
	200

This enumeration excludes the three ear ossicles, and the sesamoids except the patellae.

ARRANGEMENT

The vertebrate skeleton has two divisions.

1. **Axial:**—Includes the framework of the trunk and the head, namely, the ribs, sternum, spinal column, sacrum, coccyx, hyoid, and skull.

2. **Appendicular:**—Made up of two girdles, the thoracic, or shoulder, and the pelvic, attaching the bones of the extremities. The thoracic girdle consists of the Clavicle and Scapula; the pelvic, of the Os Innominates and the Sacrum.

ARTICULATIONS OR JOINTS

COMPONENT PARTS

At least two bones	Essential
At some time, either cartilage or ligamentous tissue	
Capsular Lig't.	Usually present
Synovial membrane	
Synovial fluid	
Cartilage	

The capsule is composed of a fibrous connective tissue. It is found in all joints, except in certain minor ones of the carpus and tarsus.

The synovial membrane is the inner lining of the capsule. The synovial fluid, used for lubricating the joint, is secreted by this membrane.

Bursae are sacks of connective tissue filled with fluid. They are found at points of great friction.

CLASSIFICATION OF JOINTS

I. SYNARTHROSES, or fixed joints

A. **Sutures**:—They are joints at first maintained by connective tissue; in the adult they exist directly between the bones.

Four Types

1. **Serrated**, or true sutures. Formed by two bones with interlocking tooth-like edges:—e. g., Interparietal Joint.

2. **Squamous**, or false sutures. One bone overlaps the other:—e. g., Temporo-Parietal Joint.

3. **Harmonic** Sutures. Formed by apposition of two plane surfaces:—e. g., Articulation between the two superior maxillary bones.

2 4. **Grooved** sutures, or schindyleses. Here one bone is received into a groove in another:—e. g., Articulation between the rostrum of the sphenoid and the vomer.

4 B. **Synchondroses**:—Joints maintained at first through cartilage, which in the adult state is replaced by bone:—e. g., Joint between the Ilium and Ischium.

3 [illegible]

II. AMPHIARTHROSES, or slightly movable joints

A. **Symphyses**:—Consist of two bony surfaces closely united by fibrous cartilage:—e. g., Symphysis Pubis. + [illegible]

B. **Syndesmoses**:—Joint of two bony surfaces with no intervening cartilage:—e. g., Sup. Tibio-Fibular Joint.

III. DIARTHROSES, or freely movable joints

1. **Ginglymus**, or hinge joint. e. g., Elbow Joint. [illegible]

2. **Reciprocal Relation**, or saddle joint:—e. g., Joint between Trapezium and First Metacarpal. [illegible]

3. **Enarthroses**, or ball and socket joints:—e. g., Hip Joint. [illegible]

4. **Arthrodia**, or gliding joints:—e. g., Sterno-Clavicular Joint. [illegible]

5. **Trochoides**, or pivot joints:—e. g., Sup. Radio-Ulnar Joint. [illegible]

6. **Condylarthroses, condyloid**, or egg-shaped joints:—e. g., Knee Joint. [illegible]

Varieties of motion permitted by the Diarthroses:—

1. Gliding.
2. Angular, including:—
    - a. Abduction.
    - b. Adduction.
    - c. Flexion.
    - d. Extension.

3. Circumduction. [illegible]
4. Rotation. [illegible]

SECTION II

THE APPENDICULAR SKELETON

THE SCAPULA

When at rest, this bone extends posteriorly from the second to seventh rib. It has no direct articulation with the trunk, being attached to it through the medium of the Clavicle (Acromio-clavicular articulation). Together with the Clavicle, it forms the shoulder girdle.

The **Body** is triangular in shape. It has:—

- **Three Borders**
  - Superior
  - Axillary
  - Vertebral
- **Three Angles**
  - Superior
  - Inferior
  - Anterior
- **Two Surfaces**
  - Anterior
  - Posterior
- **Two Processes**
  - Coracoid
  - Spinous

BORDERS

Superior:—Shortest. Extends from Sup. Angle to base of Coracoid Process, where it shows a deep indentation, the **Suprascapular Notch,** for the transmission of the **Suprascapular N.** In the recent state this notch is bridged over by the **Transverse Lig't.,** over which passes the **Suprascapular A.** In some specimens the ligament will be seen to have calcified, leaving a distinct foramen for the nerve. Immediately internal to the Notch, and from the Transverse Lig't., we have the origin of the **Post. belly of the Omo-hyoid M.**

SUMMARY

1. Origin Post. belly Omo-hyoid.
2. Transverse Lig't., overlaid by A.
3. Suprascapular notch, transmitting N.

Axillary (Anterior):—Thickest, concave. Extends from the Glenoid Cavity to the Inf. Angle. Shows, beginning at the lower margin of the Glenoid Cavity and extending downward about an inch, a triangular rough area or a distinct eminence, the **Infraglenoid Tubercle,** giving origin to the **Long Head of the Triceps M.** Anteriorly, on the border, is a longitudinal groove for part of the origin of the **Subscapularis M.**

Running transversely across this border, below the Tubercle, is a narrow, usually poorly marked groove for the **Dorsalis Scapulae A.**

SUMMARY

1. Infraglenoid Tubercle. Origin Long Head of Triceps.
2. Transverse groove for Dorsalis Scapulae A.
3. Longitudinal groove for part origin of Subscapularis.

Vertebral (Posterior): Longest, convex. Extends from Sup. to Inf. Angle. Portion above level of spine on its Post. edge, gives insertion to the **Levator Anguli Scapulae M.** Opposite the spine is the insertion of the

Rhomboideus Minor M., and below this the insertion of the **Rhomboideus Major M.** At the angle is commonly found a minor origin of the **Latissimus Dorsi M.** On the Ant. edge of the border, throughout its entire extent, we have the insertion of the **Serratus Magnus M.**

SUMMARY

Posteriorly

1. Insertion Levator Anguli Scapulae.
2. Insertion Rhomboideus Minor.
3. Insertion Rhomboideus Major.
4. Origin Latissimus Dorsi.

Anteriorly

1. Insertion Serratus Magnus.

THE ANGLES

Superior:—Formed by junction of Sup. and Vertebral borders. Gives slight insertion to the **Levator Anguli Scapulae M.**

Inferior:—At junction of Vertebral and Axillary borders. Known as "the angle" from its use as a landmark in practice.

Anterior:—This angle is the **Glenoid Cavity,** interposed between the Sup. and axillary borders. The Glenoid Cavity, or Fossa, is a shallow, pear-shaped depression, deepened for the reception of the head of the **Humerus** by the **Glenoid Lig't.**, which surmounts its slightly raised edge. Above this edge is found the **Supraglenoid Tubercle** for the origin of the **Long Head of the Biceps M.** We may also consider with this angle:

The Coracoid Process:—Extends outward and downward below the Clavicle, and ends on the inner side of the shoulder joint. It presents from within outward:—(1) A rounded prominence, the **Conoid Tubercle,** for the attachment of the **Conoid Lig't.**

(2) **The Trapezoid Ridge,** attaching the **Trapezoid Lig't.**

(3) A second ridge on the outer side of the process, facing the Acromion, for the **Coraco-acromial** and **Coraco-humeral Lig'ts.**

(4) A rough area at the tip of the process, giving origin to the common tendon of the **Coraco-brachialis M.** and **Short Head of the Biceps M.** On the tip internal to this origin, is found the insertion of the **Pectoralis Minor M.**

SUMMARY OF CORACOID PROCESS

Muscles:—

1. Insertion Pectoralis Minor.
2. Origin Coraco-brachialis.
3. Origin Short Head of the Biceps.

Ligaments:—

1. The Conoid.
2. The Trapezoid.
3. The Coraco-acromial.
4. The Coraco-humeral.
5. The Transverse.

SURFACES

Anterior (Venter):—Concave. Forms **Subscapular Fossa,** bearing three or four oblique ridges and giving origin to the **Subscapularis M.** Along the entire Vertebral edge is the insertion of the **Serratus Magnus M.**

Posterior (Dorsum):—Convex. Divided by the spine into two fossae, the **Supraspinous** and the **Infraspinous.** The former gives origin to the **Supraspinatus M.**; the latter to the **Infraspinatus M.** Near "the angle," from a well-marked thickened area, the **Teres Major M.** arises. Above this and extending along the axillary border nearly to the Glenoid Fossa, is found the origin of the **Teres Minor M.** This last narrow region of origin is crossed in its upper part by the groove for the **Dorsalis Scapulae A.**

The Spine:—Triangular with two free borders, External and Posterior. The Ext. border, with the raised edge of the Glenoid Fossa, forms the **Great Scapular Notch,** transmitting the terminal branches of the **Suprascapular A. and N.** The Post. border shows two lips, an upper and a lower. The upper lip as far as the Acromion, and often continuing upon its Int. border, gives part insertion to the **Trapezius M.**; the lower lip gives partial origin to the **Deltoid M.** The **Acromion** is usually quadrilateral. Internally, it bears an elongated facet for articulation, with a similar facet at the acromial end of the Clavicle (Acromio-clavicular). Anterior to this facet, is the short **Preclavicular border,** attaching the **Coraco-acromial Lig't.** The outer border bears ridges for attachment of the **Deltoid M.**

SUMMARY

1. Supraspinous Fossa. Origin Supraspinatus.

2. Spine. Insertion Trapezius and Deltoid. Attachment Coraco-acromial Lig't. Articular facet for Clavicle.

3. Infraspinous Fossa. Origin Infraspinatus, Teres Minor, and Teres Major.

To tell a R. Scapula from a L., the bone must be placed so that the concave surface faces anteriorly, and the Glenoid Cavity externally.

ARTICULATIONS

With **Clavicle** and **Humerus.**

Acromio-Clavicular

The Acromion, by an elongated oval facet, articulates with a similar facet on the Acromial extremity of the Clavicle.

Ligaments

1. **Capsular.**

A wedge-shaped Fibro-cartilage is usually present.

Type of Joint:—Arthrodial.

The **Coraco-clavicular Lig't.** closely unites the Inf. surface of the Acromial extremity of the Clavicle with the Sup. surface of the Coracoid Process.

It has Two Divisions.

1. **Conoid.**
2. **Trapezoid.**

THE CLAVICLE

The Clavicle extends transversely across the upper Ant. part of the thorax from the Sternum to the Acromion. The first rib passes beneath its Sternal extremity. Internally, it articulates with the Manubrium of the Sternum (Sterno-Clavicular articulation), and with the cartilage of the first rib (Costo-Clavicular). Externally, it articulates with the Scapula (Acromio-Clavicular). It is a long bone having a doubly curved shaft, a thick triangular-shaped inner extremity, and a flattened outer one.

The **Shaft** is divided for convenience of study into an inner two-thirds, and an outer one-third.

INNER TWO-THIRDS

Three borders:—
- Superior
- Anterior
- Posterior

Three surfaces:—
- Anterior
- Posterior
- Inferior

Borders

Superior:—Extends outward from the highest point on the Sternal Extremity, and continues as the Post. border of the outer third. On its inner portion it shows a slight eminence for the partial origin of the **Sterno-cleido-mastoid M.**

Anterior:—Convex, and largely subcutaneous. Begins internally below a rough area and continues, from the Deltoid Tubercle, as the Ant. border of the outer third. From the inner portion arises part of the **Pector-**

alis Major M. The outer is covered by the **Platysma Myoides M.**

Posterior:—Concave. Extends from the **Rhomboid Impression** internally, to the Conoid Tubercle externally, where it unites with the Sup. and is continued as the Post. border of the outer one-third.

Surfaces

Anterior:—Between Sup. and Ant. borders. It presents, separated by a ridge, partial origins of the **Sterno-cleido-mastoid** and **Pectoralis Major M.** Its outer portion is covered by the **Platysma Myoides M.**

Posterior:—Between the Sup. and Post. borders, terminating externally as the Post. border of the outer third. Close to its Sternal termination, from a smooth widened portion, it gives partial origin to the **Sterno-hyoid M.**

Inferior:—Between the Ant. and Post. borders. At the inner end a rough area, the **Rhomboid Impression,** attaches the **Rhomboid Lig't.** Beginning at the apex of this impression and extending outward is the **Subclavian groove** for the insertion of the **Subclavius M.,** and for the attachment by its two lips of the **Costo-coracoid** membrane.

SUMMARY

Superiorly:—Origin Sterno-cleido-mastoid.

Anteriorly:—1. Origin Pectoralis Major. 2. Overlaid by Platysma Myoides.

Posteriorly:—1. Rhomboid Impression:—Rhomboid Lig't. 2. Subclavian groove:—Costo-coracoid membrane, and insertion Subclavius.

OUTER ONE-THIRD

Two borders:—	**Two surfaces:—**
Anterior	Superior
Posterior	Inferior

Borders

Anterior:—Concave. Begins internally in a small prominence, the **Deltoid Tubercle.** From this tubercle and from the roughened border to the end of the bone, part of the **Deltoid M.** arises.

Posterior:—Convex. Begins at a point opposite the Deltoid tubercle. Bears a number of small rough ridges, giving partial insertion to the **Trapezius M.**

Surfaces

Superior:—In the main, smooth and subcutaneous.

Inferior:—Shows posteriorly an eminence, the **Conoid Tubercle,** attaching the **Conoid Lig't.,** and, running forward and outward from this, a well-marked ridge, the **Trapezoid Ridge,** attaching the **Trapezoid Lig't.** Just external to this ridge, a shallow depression is seen for the passage of the tendon of the **Supraspinatus M.**

THE EXTREMITIES

Sternal (Int.):—Triangular. Bears two facets continuous with one another: (a) Large and triangular for articulation with the **Manubrium.** (b) Inferiorly, small and semi-circular for articulation with the **cartilage** of the **first rib.**

Acromial (Ext.):—Shows a small oblong facet for articulation with the **Acromion.**

To tell a R. Clavicle from a L., place the bone with the Sternal extremity internally, keep uppermost the smooth surface of the Acromial extremity, and have its concavity forward.

ARTICULATIONS

With **Sternum, First Rib,** and **Scapula.**

Sterno-Clavicular

The Sternal extremity of the Clavicle, articulates by one facet with the upper angle of the Manubrium and with the First Costal Cartilage.

Ligaments

1. **Capsular,** strengthened by two bands, the Ant. and Post. Sterno-Clavicular Lig'ts.
2. **Inter-clavicular,** joining the Sternal ends of the Clavicles.
3. **Rhomboid** or Costo-clavicular, extending from the Rhomboid Impression to the First Costal Cartilage.

An inter-articular fibro-cartilage is always present.

Type of Joint:—Arthrodial.

THE HUMERUS

The Bone of the Arm

It consists of a **shaft** and **two extremities.**

UPPER EXTREMITY

Head.
Greater Tuberosity.
Lesser Tuberosity.
Bicipital Groove.

Head:—Globular. Surrounded by a groove, forming the **Anatomical Neck** of the bone, and attaching the **Capsular Lig't.** with its strengthening bands.

Greater Tuberosity:—A large rough eminence situated externally, and separated from the Lesser Tuberosity by the **Bicipital Groove.** Superiorly, from before backward, by three facets it gives insertion to the **Supraspinatus, Infraspinatus,** and **Teres Minor M.**

Lesser Tuberosity:—Shows a smooth Sup. surface lodging a bursa, and below this a ridge, giving insertion to the **Subscapularis M.**

Bicipital Groove:—Beginning at the Anatomical Neck it passes downward between the two tuberosities. The Ext. lip of the groove gives insertion to the **Pectoralis Major M.**; the Int. lip to the **Teres Major M.** The groove transmits the tendon of the **Long Head** of **Biceps M.**, and the **Ant. Circumflex A.** supplying the shoulder joint.

The **Latissimus Dorsi M.** inserts in the floor of the Bicipital Groove.

Between the tuberosities and the shaft is a constricted area, the **Surgical Neck,** so-called from the frequency of fracture at this place.

SUMMARY

1. Head:—Anatomical Neck and Capsular Lig't.
2. Greater Tuberosity:—Insertion Supraspinatus, Infraspinatus, Teres Minor.
3. Lesser Tuberosity:—Bursa. Insertion Subscapularis.
4. Bicipital Groove:—Insertion Teres Major, Pectoralis Major, and Latissimus Dorsi. Transmits Ant. Circumflex, and Long Head of Biceps.
5. Surgical Neck.

SHAFT

Three borders:—
Anterior
Internal
External

Three surfaces:—
Internal
External
Posterior

Borders

Anterior:—Begins as the Ext. Lip of the Bicipital Groove and, becoming less distinct, extends to the lower extremity, where it terminates in a ridge separating the Capitellum and Trochlea. From the lower two-thirds and the adjacent surface, arises the **Brachialis Anticus M.**

Interior:—Extends from the Post. margin of the Lesser Tuberosity to the Int. Condyle. The lower one-third is known as the **Int. Supracondylar Ridge.** It, with the border proper, attaches the **Int. Intermuscular Septum.**

External:—Extends from the Post. part of the Greater Tuberosity to the Ext. Condyle.

In the middle of its course, this border is broken by the **Musculo-spiral Groove,** transmitting the **Musculo-**

spiral N., and **Sup. Profunda A.** This groove must not be mistaken for the **Spiral Groove,** which is larger and lies immediately above it under the Deltoid Eminence and wholly upon the Ext. surface. Below the Musculo-spiral Groove the border is called the **Ext. Supracondylar Ridge,** and attaches the **Ext. Intermuscular septum.** Near the Condyle is the origin of the **Brachio-radialis,** or **Supinator Longus M.,** and below it the origin of the **Extensor Carpi Radialis Longior M.**

Surfaces

Internal:—Plain and smooth. Bounded by the Ant. and Int. Borders. Half-way down, near the Int. Border, we find a slight ridge or tubercle for the insertion of the **Coraco-brachialis M.**

External:—Convex and contorted. Lies between the Ant. and Ext. borders. Near the middle, this surface presents the **Deltoid Eminence,** giving insertion to the **Deltoid M.** Below this eminence and parallel to it, lies the broad **Spiral Groove** with the Musculo-spiral Groove immediately beneath it.

Posterior:—Faces internally above and posteriorly below, and is limited by the Int. and Ext. borders. The **Musculo-spiral Groove,** originating upon this surface, crosses downward and outward to the Ext. Surface. Above this groove to the Ext. border, it attaches the origin of the **Ext. Head of the Triceps M.** Below the groove to the Ext. Supracondylar Ridge, we find the origin of the **Int. Head of the Triceps M.**

SUMMARY

Anteriorly:—Origin Brachialis Anticus.

Internally:—1. Insertion Coraco-brachialis.

2. Internal Supracondylar Ridge attaching Int. Intermuscular Septum.

Postero-externally:—1. Deltoid Eminence. Insertion of Deltoid.

2. Spiral Groove.
3. Origin Outer Head Triceps.
4. Musculo-spiral Groove.
5. Origin Inner Head Triceps.
6. Supracondylar Ridge. Origin Brachio-radialis and Extensor Carpi Radialis Longior.

LOWER EXTREMITY

Presents for examination:—

Int. Condyle.
Ext. Condyle.
Articular Surface.
Coronoid and Radial Fossae.
Olecranon Fossa.

Int. Condyle:—Larger and slightly roughened anteriorly. Posteriorly, bears a shallow groove for the **Ulnar N.**

Gives origin to the **Pronator Radii Teres M.** and the tendon common to the **Flexor Carpi Ulnaris, Flexor Carpi Radialis, Flexor Sublimis Digitorum,** and **Palmaris Longus M.**, and attaches the **Int. Lat. Lig't.** of the Elbow-Joint.

Ext. Condyle:—Posteriorly, we have the origin of the **Anconeus M.**; and externally, by a common tendon, the origin of the **Extensor Carpi Radialis Brevior, Extensor Carpi Ulnaris, Extensor Communis Digitorum, Extensor Minimi Digiti,** and **Supinator Brevis M.**, and attachment of the **Ext. Lat. Lig't.** of the Elbow-Joint.

Articular Surface:—Consists of two distinct parts, an inner and outer, separated by a ridge.

1. Int. Portion:—Called the **Trochlea** or Trochlear Surface. Shaped like an hour glass. Limited superiorly, in front by the **Coronoid Fossa,** in back by the **Olecranon Fossa.**

It articulates with the **Greater Sigmoid Cavity** of the Ulna.

2. Ext. Portion:—Spherical. Bounded above by the **Radial Fossa.** It articulates with the cup-shaped depression upon the head of the Radius, and is known as the **Capitellum** of the Humerus.

Fossae:—Anteriorly, above the Trochlea, we have the small **Coronoid Fossa** for the reception of the **Coronoid Process** of the Ulna in extreme flexion of the forearm. Above the Capitellum, is the shallow **Radial Fossa,** which, under the same conditions, receives the **head** of the Radius.

Posteriorly, above the Trochlea, appears the **Olecranon Fossa,** receiving the **Olecranon Process** of the Ulna in extreme extension of the forearm.

SUMMARY

1. **Anteriorly:**—Coronoid and Radial Fossae.
2. **Internally:**—Condyle, origin Pronator and Flexors.
3. **Externally:**—Condyle, origin Supinator, Anconeus, and Extensors.
4. **Posteriorly:**—Olecranon Fossa.
5. **Articular surfaces:**—Trochlea and Capitellum.

To tell a R. Humerus from a L., place the bone with the head facing inward and the Olecranon Fossa backward.

ARTICULATIONS

With **Scapula, Radius,** and **Ulna.**

The Shoulder-Joint

The Head of the Humerus articulates with the Glenoid Cavity of the Scapula.

Ligaments

1. **Glenoid** surrounds and deepens the Glenoid Cavity. It is attached by its base to the border of the cavity, and has a free Ext. margin.
2. **Capsular** attaches above and on the inner side to the edge of the Glenoid Cavity, externally to the Glenoid Lig't., and below to the Anatomical Neck of the Humerus.

The Capsule is strengthened by: a. **Coraco-humeral.** Starting from the Coracoid Process it fuses with the Capsule.

b. **Gleno-humeral.** Wholly within the Capsule. It consists of three bands, Superior, Middle, and Inferior.

Type of Joint:—Enarthrodial.

THE ULNA

The inner bone of the forearm. Articulates above with the Humerus and the Radius. It is a long bone having a shaft and two extremities.

UPPER EXTREMITY

The Olecranon Process.
The Coronoid Process.
The Greater Sigmoid Cavity.
The Lesser Sigmoid Cavity.

The Olecranon Process:—A four-sided eminence.

Five Surfaces { Superior, Anterior, Posterior, Internal, External

Superior:—Shows a prominence or beak anteriorly and externally. A poorly marked groove, immediately behind the Ant. margin, attaches the **Post. Lig't.** of the Elbow-Joint. Posterior to this groove the entire surface gives insertion to the **Triceps M.**

Anterior:—Deeply concave, forming the **Greater Sigmoid Cavity.**

Posterior:—Subcutaneous and triangular. Limited above by an irregular ridge, and laterally by two well-marked lines converging to form the Post. border of the shaft. It is covered by a bursa.

Internal:—Posterior to the margin of the Greater Sigmoid Cavity, a slight groove marks the attachment of the **Int. Lat. Lig't.** of the Elbow-Joint.

External:—Shows first a groove, the continuation of those on the Int. and Sup. surfaces, for the attachment of the **Ext. Lat. Lig't.** of the Elbow-Joint. These lateral Lig'ts. are simply thickenings of a single capsular investment, hence the continuity of their attaching grooves. Posterior to this groove, appears a wider one for the upper part of the insertion of the **Anconeus M.**

The Coronoid Process:—A projecting shelf.

Four Surfaces

- Superior
- Inferior
- Internal
- External

Superior:—Forms the floor of the Greater Sigmoid Cavity.

Inferior:—Rough and triangular. Around its upper margin runs a groove, giving attachment to the **Ant. Lig't.** of the Elbow-Joint, which is also a thickening of the capsular.

Below this, a rough triangular area gives insertion to the **Brachialis Anticus M.** The apex often appears as a distinct protuberance, and is known as the **Tuberosity** of the Ulna, attaching the **Oblique Lig't.**

The inner line gives origin to small slips of three muscles. From above downward, they are the **Flexor Sublimis Digitorum, Pronator Radii Teres,** and **Flexor Longus Pollicis.**

Internal:—Usually a deep depression. A groove below its upper margin attaches the **Int. Lat. Lig't.**

External:—Smooth and concave. Forms the **Lesser Sigmoid Cavity,** to the Ant. and Post. margins of which, the **Orbicular Lig't.** attaches.

The **Greater Sigmoid Cavity**:—Concave. Made up of the Ant. surface of the Olecranon and the Sup. surface of the Coronoid Process. It shows two articular surfaces, the upper oval, the lower quadrilateral, separated by a narrow non-articular area. The **Trochlea** of the Humerus is received by this cavity.

The **Lesser Sigmoid Cavity**:—A shallow oblong depression on the Ext. surface of the Coronoid Process for articulation with the circumferential facet of the head of the Radius.

SUMMARY

UPPER EXTREMITY

1. The Olecranon Process.
   a. Attachment of Post., Ext. Lat., and Int. Lat. Lig'ts.
   b. Insertion Triceps.
   c. Partial insertion Anconeus.

2. The Coronoid Process.
   a. Attachment of Ant. and Int. Lat. Lig'ts.
   b. Insertion Brachialis Anticus.
   c. Origin Flexor Sublimis Digitorum.
      "   Pronator Radii Teres.
      "   Flexor Longus Pollicis.
   d. Tuberosity of the Ulna attaching the Oblique Lig't.

3. Greater Sigmoid Cavity articulating with the Trochlea.

4. Lesser Sigmoid Cavity articulating with the head of the Radius.

THE SHAFT

Three borders:—	Three surfaces:—
Anterior	Anterior
Posterior	Posterior
External	Internal

Borders

Anterior:—Arises from the inner edge of the Coronoid Process, curving posteriorly in its lower fourth, where it is roughened for the origin of the **Pronator Quadratus M.**

Posterior:—Formed by the junction of the inner and outer margins of the Post. surface of the Olecranon. In its upper three-fourths it is very distinct, and attaches an aponeurosis, from which partially arise the **Extensor Carpi Ulnaris, Flexor Profundus Digitorum,** and **Flexor Carpi Ulnaris M.** The lower fourth of the border is rounded and terminates upon the **Styloid Process.**

External:—Arises from the junction of two ridges, continuations of the Ant. and Post. margins of the **Lesser Sigmoid Cavity.** Between the ridges we have a depression, the **Bicipital Fossa,** giving partial origin to the **Supinator Brevis M.,** and receiving the **Bicipital Tuberosity** of the Radius in pronation. The Post. ridge is more prominent and is known as the **Supinator Ridge.** It also gives origin to the **Supinator Brevis M.** The border ends in the head of the Ulna, and becomes indistinct above the lower extremity. Throughout its visible extent, it attaches the **Interosseous Membrane,** and is therefore called the "**Interosseous Border.**"

Surfaces

Anterior:—Concave. Between the Ant. and Ext. borders. The upper three-fourths of this surface gives further origin to the **Flexor Profundus Digitorum M.** The lower fourth is rough, and from it arises the **Pronator Quadratus M.**

Posterior:—Ridged. Between the Ext. and Post. borders. Superiorly, a small ridge, the **Oblique Line** of the Ulna, runs downward and backward from the Supinator Ridge, and gives origin to part of the **Supinator Brevis M.** Above it we have further insertion of the **Anconeus M.** Below, a well marked Vertical Line is often found, dividing the surface into two parts. The Int. portion gives part origin to the **Extensor Carpi Ulnaris M.**; the Ext. portion, from above downward, to the **Extensor Ossis Metacarpi Pollicis, Extensor Longus Pollicis,** and the **Extensor Indicis M.**

Internal:—Concave above, convex below. Between the Ant. and Post. borders. The upper two-thirds gives origin to part of the **Flexor Profundus Digitorum M.** The lower third is smooth and covered by the flexor tendons.

SUMMARY

Anteriorly:—1. Origin Flexor Profundus Digitorum.
2. Origin Pronator Quadratus.
Posteriorly and Externally:—1. Insertion Anconeus.
2. Bicipital Fossa for Bicipital Tuberosity.
Supinator Ridge.
Oblique Line.
All give origin to the Supinator Brevis.
3. Interosseous Border.

4. Vertical Line.
   Internally, origin Extensor Carpi Ulnaris.
   Externally, origin Extensor Ossis Metacarpi Pollicis.
   " origin Extensor Longus Pollicis.
   " origin Extensor Indicis.
5. Aponeurotic origin Extensor Carpi Ulnaris.
   " " Flexor Profundus Digitorum.
   " " Flexor Carpi Ulnaris.

THE LOWER EXTREMITY

Made up of the Head of the Ulna and the Styloid Process.

Head:—Rounded. A crescentic facet externally articulates with the Sigmoid Cavity of the Radius.

The Inf. surface, by means of a kidney-shaped facet, articulates with the **Triangular Fibro-cartilage** intervening between the Ulna and the Cuneiform. The apex of the cartilage attaches to a groove between the Head and Styloid Process.

Styloid Process:—Projects downward from the postero-internal surface of the head. At its tip it gives attachment to the **Int. Lat. Lig't. of the wrist.** On the Post. surface, external to the process, there is a groove for the passage of the tendon of the Extensor Carpi Ulnaris M.

To tell a R. from L. Ulna, place the bone with greater Sigmoid Cavity facing anteriorly, and the Styloid Process downward and upon the Int. aspect of the Head.

THE RADIUS

The outer bone of the forearm. It consists of a **shaft** and **two extremities.**

UPPER EXTREMITY

1. **Head**:—Bears superiorly a smooth depression for articulation with the Capitellum of the Humerus. Circumferentially, another smooth articular surface appears. As the Radius rotates, this is in contact internally, with the Lesser Sigmoid Cavity of the Ulna, externally, with the Orbicular Lig't., which surrounds the Head and holds it in place.

2. **Neck**:—Between the Head and the Bicipital Tuberosity. Except upon a small part of the Int. surface, the Neck receives the insertion of the **Supinator Brevis M.**

THE SHAFT

Three borders:—	**Three surfaces**:—
Anterior	Anterior
Posterior	Posterior
Internal	External

Borders

Anterior:—From the Ant. margin of the Bicipital Tuberosity to the Styloid Process. In its upper half it is distinct and is called the **Oblique Line** of the Radius. Here it gives part origin to the **Flexor Sublimis Digitorum M.**, and separates the origin of the Flexor Longus Pollicis M. from the insertion of the Supinator Brevis M. The border, in its lower fourth, often ridge-like, gives insertion to the **Pronator Quadratus M.** Immediately above the Process it expands, forming a triangular area for the insertion of the **Brachio-radialis M.**

Posterior:—This border appears as a dull ridge in the middle two-fourths of the shaft.

Internal:—Sharpest. Extends from the Int. edge of the Bicipital Tuberosity to the lower extremity, where it divides to enclose the **Sigmoid Cavity.** It attaches the **Interosseous Membrane** and is called the **"Interosseous Border."**

Surfaces

Anterior:—Concave above, convex below. Limited superiorly by the upper margin of the Bicipital Tuberosity, externally by the Oblique Line, and internally by the Interosseus Border. The **Tuberosity** is a large eminence facing upward and inward. Above, it lodges a bursa, and below, it gives insertion to the **Biceps M.**

Below this, the Oblique Line, by its upper two-thirds, attaches the main origin of the **Flexor Longus Pollicis M.** In the lower third a roughened area gives insertion to the **Pronator Quadratus M.**

Posterior:—Convex, concave, and then convex again. In the upper third this surface continues the insertion of the **Supinator Brevis M.** The middle third above, gives part origin to the **Extensor Ossis Metacarpi Pollicis M.**, and below, to the **Extensor Brevis Pollicis M.** The lower third is smooth and is covered by the extensor tendons.

External:—Convex. Superiorly, corresponding to a similar area upon the Post. surface, we find a continuation of the insertion of the **Supinator Brevis M.** Half-way down the surface, a well-marked elevation indicates the insertion of the **Pronator Radii Teres M.**

SUMMARY

Anteriorly:—1. Bicipital Tuberosity.
Lodges a bursa. Insertion Biceps.
2. Oblique Line. Origin Flexor Sublimis Digitorum.
3. Origin Flexor Longus Pollicis.
4. Insertion Pronator Quadratus.
5. Interosseous Border attaching Interosseous Membrane.

Posteriorly:—1. Insertion Supinator Brevis.
2. Origin Extensor Ossis Metacarpi Pollicis.
3. Origin Flexor Brevis Pollicis.

Externally:—1. Insertion Supinator Brevis.
2. Insertion Pronator Quadratus.
3. Insertion Brachio-radialis.

Pronators and Supinators **insert** on the **Radius.**

THE LOWER EXTREMITY:—Quadrate in shape.

Five surfaces:—

Anterior
Posterior
Internal
External
Inferior

Anterior:—Shows a rough margin for the attachment of the **Ant. Lig't.** of the Wrist-Joint.

Posterior:—Grooved. Passes from the Post. edge of the Sigmoid Cavity to the Ant. margin of the Styloid Process, including it. The Surface is broken by **five grooves** for the extensor tendons:

1. Upon the Post. edge of the Sigmoid Cavity, and very indistinct. Transmits the **Extensor Minimi Digiti M.**

2. Shallow and slightly external to this, for the **Extensor Communis Digitorum,** and the **Extensor Indicis M.**

3. Well defined, for the **Extensor Longus Pollicis M.**

4. Broad and shallow, transmitting the **Extensor Carpi Radialis Brevior** and **Longior M.**

5. Passing over the Styloid Process and carrying the **Extensor Brevis Pollicis** and the **Extensor Ossis Metacarpi Pollicis M.**

The Styloid Process attaches the **Ext. Lat. Lig't.** of the wrist.

Internal:—The **Sigmoid Cavity,** articulating with the head of the Ulna and attaching by its lower margin the **Triangular Fibro-cartilage.**

External:—Presents the **Styloid Process** attaching the **Ext. Lat. Lig't.,** and grooved externally for the passage of the tendons of the **Extensor Brevis Pollicis,** and the **Extensor Ossis Metacarpi Pollicis M.**

Inferior:—Concave, articular. A faintly marked transverse ridge divides it into an outer triangular area, articulating with the **Scaphoid,** and an inner quadrilateral one, articulating with the **Semilunar.**

SUMMARY

Anteriorly:—Ant. Lig't.

Posteriorly:—Post. Lig't.

1. Grooves for tendons.
    - a. Extensor Minimi Digiti.
    - b. Extensor Communis Digitorum.
      Extensor Indicis.
    - c. Extensor Longus Pollicis.
    - d. Extensor Carpi Radialis Longior.
      Extensor Carpi Radialis Brevior.
    - e. Extensor Brevis Pollicis.
      Extensor Ossis Metacarpi Pollicis.
2. Styloid Process:—Ext. Lat. Lig't.

Internally:—Sigmoid Cavity. Attachment Triangular Fibro-cartilage.

Inferiorly:—1. Internally, facet for Semilunar.
2. Externally, facet for Scaphoid.

ARTICULATIONS

With four bones, the **Humerus, Ulna, Scaphoid,** and **Semilunar.**

THE ELBOW-JOINT

The Trochlea of the Humerus articulates with the Greater Sigmoid Cavity of the Ulna, and the Capitellum Humeri with the facet upon the Sup. surface of the Head of the Radius.

Ligaments

1. **Capsular**:—Four thickenings of this ligament are described. They are not distinct structures.

a. **Anterior**:—Extends from the Humerus above the Coronoid and Radial Fossae, and from the bases of the

Condyles to the Orbicular Lig't. and the Ant. margin of the Coronoid Process.

b. **Posterior**:—Extends from Condyle to Condyle bridging the Olecranon Fossa, and attaches below in a groove upon the Sup. surface of the Olecranon.

c. **Internal**:—Extends from the Int. Condyle to the margin of the Coronoid Process and the side of the Olecranon.

d. **External**:—Extends from the Ext. Condyle and blends with the Orbicular Lig't.

Type of Joint:—Ginglymus.

THE SUPERIOR RADIO-ULNAR ARTICULATION

The circumferential facet upon the Head of the Radius, encircled by the Orbicular Lig't., articulates with the Lesser Sigmoid Cavity of the Ulna.

Ligaments

1. **Orbicular**:—Surrounds the head of the Radius. Superiorly, it is attached to the Capsule of the Elbow-Joint. Inferiorly, fibres pass from it to attach around the Neck of the Radius, thus forming a more or less definite Capsular Lig't.

Type of Joint:—Trochoides.

The shafts of the Radius and Ulna are connected by two ligaments.

1. **Oblique**:—Inconstant. Extends from the tubercle of the Ulna to the beginning of the Oblique Line of the Radius.
2. **Interosseous Membrane**:—Attached to the Interosseous Borders of the two bones.

THE INFERIOR RADIO-ULNAR ARTICULATION

The Sigmoid Cavity of the Radius articulates with the crescentic facet upon the head of the Ulna.

Ligaments

1. **Capsular:**—Has two strengthening bands.

a. **Anterior:**—Extends transversely from the Ant. margin of the Sigmoid Cavity of the Radius to the Ant. surface of the Head of the Ulna.

b. **Posterior:**—Has the same relative attachments.

2. **The Triangular Fibro-cartilage.**

The base is external, and is attached to the border between the Inf. Surface of the Radius and the Sigmoid Cavity. The apex is internal, and is attached by a small ligamentous band to a groove upon the Inf. surface, between the Head and Styloid Process, of the Ulna.

THE HAND

The hand lies normally with the palm forward and thumb outward. It consists of three groups of bones:—The **Carpus, Metacarpus,** and **Phalanges.**

THE CARPUS

This group consists of eight bones, arranged in two rows, one above the other; in the upper row (from the Radial to the Ulnar side) Scaphoid, Semilunar, Cuneiform, and Pisiform; in the lower, Trapezium, Trapezoid, Os Magnus, and Unciform. The Scaphoid, Semilunar, and Cuneiform, are joined into single segment by Interosseous Lig'ts. The Pisiform articulates with the Cuneiform but takes no part in the Wrist-Joint, being practically a sesamoid bone in the tendon of the Flexor Carpi Ulnaris M.

The Carpal bones, except the Pisiform, have certain points in common. Excluding it, they have:—Six surfaces.

1. Ant. and Post. surfaces are rough (non-articular), except part of the Ant. surface of the Cuneiform. In all cases both these surfaces give partial attachment to the general capsule of the Wrist-Joint.

2. Sup. and Inf. surfaces are articular.

3. Int. and Ext. surfaces are articular except the subcutaneous surfaces of those limiting each row.

UPPER ROW

SCAPHOID

Surfaces

Superior, or Proximal:—Convex and triangular. Articulates with a similar surface on the Radius.

Inferior, or Distal:—Also convex and triangular, and divided by a ridge into two parts; an outer for articulation with the Trapezium, an inner for the Trapezoid.

Anterior, or Palmar:—Ends anteriorly in a tuberosity which attaches the Ant. Annular Lig't., and part of the origin of the **Abductor Pollicis M.**

Posterior:—Rough.

Internal:—Two parts.

a. Superiorly, a flat crescentic facet for articulation with the Semilunar.

b. Inferiorly, a deep concave facet for the Head of the Os Magnum.

External:—Rough, and continuous with the Ant. surface. Attaches the **Ext. Lat. Lig't.** of the wrist.

SUMMARY

The Scaphoid articulates with five bones, **Radius, Trapezium, Trapezoid, Semilunar,** and **Os Magnum.**

Attachments

Ligamentous:—1. Anterior Annular.
2. External Lateral.

Muscular:—Part origin Abductor Pollicis M.

SEMILUNAR

Surfaces

Superior:—Convex and quadrilateral. Articulates with a corresponding concavity on the Radius.

Inferior:—Bears two facets separated by a slight ridge.

a. The inner is long and narrow and articulates with the Unciform.

b. The outer, larger, articulates with the head of the Os Magnum.

Anterior:—Rough and convex.

Posterior:—Rough.

Internal:—Semilunar in outline. Bears a plane quadrilateral facet for articulation with the Cuneiform.

External:—Also semilunar in outline. Bears a long crescentic facet for articulation with the Scaphoid.

SUMMARY

The Semilunar articulates with five bones, **Radius, Unciform, Os Magnum, Cuneiform,** and **Scaphoid.**

CUNEIFORM

Wedge-shaped

Surfaces

Superior:—1. Shows externally, a small circular area for articulation with the Triangular Fibro-cartilage.

2. Internally, a rough non-articular portion.

Inferior:—Bears a long double curved facet for articulation with the Unciform.

Anterior:—Shows internally, a plane circular facet for articulation with the Pisiform.

Posterior:—Narrow and rough.

Interior:—Forms apex of wedge, and attaches the **Int. Lat. Lig't.** of the wrist.

External:—Forms the base of the wedge, and has a plane quadrilateral facet for articulation with the Semilunar.

SUMMARY

The Cuneiform articulates with three bones, the **Unciform, Pisiform, and Semilunar,** and with the **Triangular Fibro-cartilage.**

Attachment

Ligamentous:—Internal Lateral.

PISIFORM

Approximately a half-sphere.

Two Surfaces

Anterior:—Attaches the **Ant. Annular Lig't.,** a partial insertion of the **Flexor Carpi Ulnaris M.,** and the origin of the **Abductor Minimi Digiti M.**

Posterior:—Bears a flat circular facet for articulation with the Cuneiform.

THE SECOND ROW

Interosseous Lig'ts. join the four bones of this row, making of them a single segment, similar to that formed by the three first bones of the upper row.

TRAPEZIUM

Easily recognized by a conspicuous ridge and groove on the Ant. surface.

Surfaces

Superior:—Has a concave facet for articulation with the Scaphoid.

Inferior:—Bears a saddle-shaped facet for articulation with the First Metacarpal.

Anterior:—Presents 1. A vertical ridge, attaching the **Ant. Annular Lig't.,** partial origins of the **Abductor Pollicis,** the **Adductor Obliquus Pollicis M.,** and origins of the **Flexor Brevis Pollicis,** the **Opponens Pollicis M.** (Flexor Brevis Ossis Metacarpi Pollicis).

2. A groove, internal to the ridge, for the transmission of the tendon of the **Flexor Carpi Radialis M.** As this tendon passes through a special tunnel in the Ant. Annular Lig't., the ligament also attaches to the extreme inner margin of this surface of the Trapezium.

Posterior:—Rough.

Internal:—Presents:

1. Superiorly a concave facet for articulation with the Trapezoid.

2. Inferiorly a narrow facet for articulation with the base of the Second Metacarpal.

External:—Rough.

SUMMARY

The Trapezium articulates with four bones, the **Scaphoid, Trapezoid,** 1st and 2d **Metacarpals.**

Attachments

Ligamentous:—Anterior Annular.

Muscular:—1. Origin Abductor Pollicis.

2. Origin Adductor Obliquus Pollicis.

3. Origin Flexor Brevis Pollicis.

4. Origin Opponens Pollicis.

TRAPEZOID

A truncated pyramid.

Surfaces

Superior:—Shows a concave, four-sided facet for articulation with the Scaphoid.

Inferior:—In shape, a blunt wedge. This fits into a corresponding groove on the base of the Second Metacarpal.

Anterior:—Gives part origin to the **Adductor Obliquus Pollicis M.**

Posterior:—Base of pyramid. Large and convex.

Internal:—The larger, lower part of this surface shows a concave facet for articulation with the Os Magnum. Above, it is rough.

External:—Bears a concave facet for articulation with the Trapezium.

SUMMARY

The Trapezoid articulates with four bones, the **Scaphoid, Os Magnum, Trapezium,** and 2nd **Metacarpal.**

Attachment

One Muscle:—Part origin of the **Adductor Obliquus Pollicis.**

OS MAGNUM

Largest bone in the Carpus. Presents for examination a Head, Neck, and Body.

Head:—Articular throughout. Supero-externally, it is convex, and fits into a concavity formed for it by the Scaphoid and Semilunar. The Int. surface is a plane, sharply marked from the rest of the Head. It forms the Sup. part of the articulation of this bone with the Unciform.

Neck:—A constricted portion immediately below the Head. It is marked by a groove on the Post. surface. Internally, the Neck is not noticeable, the facet for the Unciform extending unbrokenly across it.

Body:—Superiorly, the body passes into the Neck and supports the Head.

Five Surfaces

Inferior:—Has three facets, articulating with the Second, Third, and Fourth Metacarpals. The Sup. surface attaches the neck.

Anterior:—Rough, for a partial origin of the **Adductor Obliquus Pollicis M.**

Posterior:—Broad and rough.

Internal:—Posteriorly and superiorly, this surface is occupied by a facet for articulation with the Unciform. The upper part of this same facet has already been noticed upon the Int. surface of the Head.

External:—Articulates with the Trapezoid.

SUMMARY

The Os Magnum articulates with seven bones, the **Scaphoid, Semilunar, Trapezoid, Unciform, 1st, 2nd, and 3rd Metacarpals.**

Attachment

Muscular:—Part of the origin of the Adductor Obliquus Pollicis.

UNCIFORM

Recognized by the hook-like process.

Surfaces

Superior:—1. Shows internally, a double curved facet for articulation with the Cuneiform.

2. Externally, a narrow facet for articulation with the Semilunar.

Inferior:—Presents two facets separated by a ridge; the inner for articulation with the Fifth Metacarpal, the outer for the Fourth Metacarpal.

Anterior:—Shows the "hook" of the Unciform. The concavity of the hook is directed inward, and limits the passage of the flexor tendons into the palm. The hook attaches the **Ant. Annular Lig't.**, and gives origin to the **Opponens Minimi Digiti** (Flexor Brevis Ossis Metacarpi Minimi Digiti), and the **Flexor Brevi Minimi Digiti M.**

Posterior:—Rough and triangular.

Internal:—Rough and continuous with the Post. surface.

External:—Bears a long vertical facet for articulation with the Os Magnum.

SUMMARY

The Unciform articulates with five bones, the **Semilunar, Cuneiform, Os Magnum, 4th and 5th Metacarpals.**

Attachments

Ligamentous:—Anterior Annular.

The complete attachment of this ligament is therefore:—

Internally:—The Pisiform and "hook" of the Unciform.

Externally:—The tuberosity of the Scaphoid, and the ridge and Int. margin of the Trapezium.

Muscular:—1. Origin Flexor Brevis Minimi Digiti.
2. Origin Opponens Minimi Digiti.

THE METACARPUS

Consists of five bones.

The First Metacarpal, that of the thumb, needs a separate description. The other four have the following points in common:—

They are long bones. The superior, or proximal extremity is the **base**; the inferior, or distal, the **head.**

Bases:—Cubical. Superiorly, they articulate with the Carpal bones.

Anteriorly and posteriorly, they are rough for ligamentous and muscular attachments.

Laterally, they articulate with one another, except the Ulnar side of the Fifth and the Radial side of the Second.

Shafts:—Anteriorly and posteriorly, ridges divide the shafts so that we have Lat. surfaces. The Post. ridge splits half way down the shaft, giving a flat Post. surface near the heads.

Heads:—Strongly convex. They project anteriorly and articulate with the Phalanges.

Posteriorly, where the lines from the splitting of the dorsal ridge end, we have tubercles. Just anterior to each tubercle is a depression. From both tubercles and depression spring the Lat. Lig'ts. of the Metacarpo-Phalangeal Joints.

PECULIARITIES OF THE DIFFERENT METACARPALS

THE FIRST METACARPAL

The shortest and stoutest. Resembles a Phalanx.

Base

Superiorly, the base bears a saddle-shaped facet for articulation with the Trapezium. Almost surrounding this articular surface is a groove which attaches the **Capsular Lig't.** Has ordinarily **no lateral facets.**

Externally, a well marked tubercle attaches the insertion of the **Extensor Ossis Metacarpi Pollicis M.**

Shaft

Two Borders:—Internal and external, not anterior and posterior, as in the case of the other Metacarpals. The Ext. border gives insertion to the **Opponens Pollicis M.**

Two Surfaces:—Anterior and posterior. Important only as distinguishing characteristics of this bone.

Head

Broad from side to side. On the palmar surface two prolongations are noticed. These articulate with sesamoid bones.

THE SECOND METACARPAL.—The Longest.

Base

Superiorly, it has three facets; the external is large and articulates with the Trapezium; the middle, large and V shaped for the Trapezoid; the internal, small and articulates with the Os Magnum.

Anteriorly, a rough area gives part insertion to the **Flexor Carpi Radialis M.**

Posteriorly, a similar area gives insertion to the **Extensor Carpi Radialis Longior M.**

Internally, a single facet articulates with the Third Metacarpal.

Externally, there is occasionally a facet for articulation with the First Metacarpal.

The Shaft and Head are characteristic.

THE THIRD METACARPAL

Base

Superiorly, it articulates with a single bone, the Os Magnum.

Anteriorly, a rough area gives insertion to the remainder of the **Flexor Carpi Radialis M.,** and part origin to the **Adductor Obliquus Pollicis M.** The complete origin of this muscle comes, therefore, from the Trapezium, Trapezoid, Os Magnum, and Third Metacarpal.

Posteriorly, there is a definite **Styloid Process,** a distinguishing characteristic of this bone. It receives the insertion of the **Extensor Carpi Radialis Brevior M.**

Internally, two small oval facets articulate with the Fourth Metacarpal.

Externally, one facet articulates with the Second Metacarpal.

Shaft

Anteriorly, gives origin throughout its entire extent to the **Adductor Transversus Pollicis M.**

Head is characteristic.

THE FOURTH METACARPAL

Base

Superiorly, articulates internally with the Os Magnum; externally, with the Unciform.

Internally, a single facet for articulation with the Fifth Metacarpal.

Externally, two facets for articulation with the Third Metacarpal.

The Shaft and Head are characteristic.

THE FIFTH METACARPAL

Base

Superiorly, it articulates with the Unciform.

Anteriorly, a rough area attaches part of the insertion of the **Flexor Carpi Ulnaris M.**

Internally, a tubercle gives insertion to the **Extensor Carpi Ulnaris M.**, and with the Shaft receives the insertion of the **Opponens Minimi Digiti M.**

Externally, bears a facet for articulation with the Fourth Metacarpal.

The Shaft and Head are characteristic.

ORIGIN OF THE INTEROSSEOUS MUSCLES

The origins of these small muscles are less confusing if given at once instead of separately.

Dorsal Interossei:—Four in number. Arise in the four Metacarpal interspaces by a head from the Lat. surface of each adjacent bone; e. g. the first arises from the outer side of the first and inner side of the second Metacarpals.

Palmar Interossei:—Three in number:—

1. Arises Ulnar side Second Metacarpal.
2. Arises Radial side Fourth Metacarpal.
3. Arises Radial side Fifth Metacarpal.

THE PHALANGES

Long bones, fourteen in all.

They are in number, three for each of the four fingers, and two for the thumb.

The First Phalanges differ in size and strength, and in the muscles they attach. Their structural characteristics are practically the same. We are able, therefore, to give a single description which will serve for the entire row.

THE FIRST (PROXIMAL) ROW

Superior or Proximal Extremity

This extremity, or base, articulates with the corresponding Metacarpal by a concave surface. A slight groove runs around this facet, attaching the Capsule of the Metacarpo-Phalangeal Joint. On each side, just below the groove, rough tubercles give partial insertion to the **Interossei M.**

Shaft

Anteriorly, concave; posteriorly, convex.

Inferior or Distal Extremity

A surface, which presents two condylar eminences separated by a groove, articulates with the corresponding Second Phalanx. This surface extends over on the palmar aspect of the bones. Laterally, these prominences and a depression just posterior to them, attach the **Lat. Lig'ts** of the Interphalangeal Joints.

Muscular Attachments to the First Phalanges

EXTRINSIC MUSCLES

Under this head we include all muscles having origin above the Carpus.

First Finger (Thumb)

Insertion Extensor Brevis Pollicis.

INTRINSIC MUSCLES

Under this head we include all muscles having their origin on or below the Carpus. Except in the case of the two Opponens muscles, all the intrinsic muscles insert upon the First Phalanges.

First Finger (Thumb)

Insertion Abductor Pollicis.
" Flexor Brevis Pollicis.
" Adductor Obliquus Pollicis.
" Adductor Transversus Pollicis.

Second (Index) Finger

Radial Side:—Insertion First Dorsal Interosseous (Abductor Indicis).

Ulnar Side:—Insertion First Palmar Interosseous.

Third (Middle) Finger

Radial Side:—Insertion Second Dorsal Interosseous.
Ulnar Side:—Insertion Third Dorsal Interosseous.

Fourth (Ring) Finger

Radial Side:—Insertion Second Palmar Interosseous.
Ulnar Side:—Insertion Fourth Dorsal Interosseous.

Fifth (Little) Finger

Radial Side:—Insertion Third Palmar Interosseous.
Insertion Flexor Brevis Minimi Digiti.
Ulnar Side:—Insertion Abductor Minimi Digiti.

The complete origin and insertion of the Interosseous. muscles has now been given. If the student will bear in mind the following rules, the task of remembering them is rendered easy.

Dorsal Interossei

Four muscles in the four interspaces; main action, abduction.

Origin:—By one head from each of the Lat. surfaces of the adjacent Metacarpals.

Insertion:—On the Lat. borders and bases of the shafts of the First Phalanges, choosing the side nearest the mid-line of the middle finger.

Palmar Interossei

Three in number; main action adduction.

Insertion:—On the Lat. borders and bases of the First Phalanges, in those places not occupied by the Dorsal Interossei;—namely, the Ulnar side of the Second and the Radial side of the Fourth and Fifth.

Origin:—From the same side of the Metacarpal bone of the same finger.

THE SECOND ROW

In dealing with the second row of Phalanges, we at once meet a Phalanx of different character in that of the thumb. This is described with those of the third row, since it is structurally one of them.

The description given for the first row of Phalanges fits accurately the four of the second row, with the exception that the superior extremities, or bases, have two depressions to receive the condylar prominences upon the distal extremities of the First Phalanges.

Muscular Attachments to the Second Phalanges

EXTRINSIC

Anteriorly:—The bases of the Second Phalanges of the second, third, fourth, and fifth fingers, by a division to either side, attach the insertion of the Flexor Sublimis Digitorum M.

Posteriorly:—The bases of the same Phalanges receive part of the insertion of the Extensor Communis Digitorum M.

Since the Extensor Indicis and Extensor Minimi Digiti fuse with the corresponding tendons of the Extensor Communis Digitorum over the Second and fifth Metacarpal bones, they also partially insert at these points.

THE THIRD (DISTAL) ROW

Known as the Ungual Phalanges. Here we include the Second Phalanx of the thumb. Upon the palmar surface of all these bones, at their free end, is a conspicuous roughness. This attaches the sensitive connective tissue at the end of the finger. Their shafts and bases need no especial description.

Muscular Attachments to the Third Phalanges

EXTRINSIC

First Finger

Anteriorly:—A concave area near the base gives insertion to the Flexor Longus Pollicis.

Posteriorly:—The base receives the insertion of the Extensor Longus Pollicis.

Second, Third, Fourth, and Fifth Fingers

Anteriorly:—Similar concave areas give insertion to the four tendons of the Flexor Profundus Digitorum.

Posteriorly:—The Extensor Communis Digitorum completes its insertion by dividing into two parts, and sending one to either side of the bases of these Phalanges.

THE WRIST-JOINT

Made up of three articulations.

1. **The Radio-Carpal.**
2. **The Intracarpal.**
3. **The Carpo-Metacarpal.**

On account of the peculiar attachment of the ligaments, we will first describe the articular surfaces concerned in all these joints.

I. The Radio-Carpal

Three Carpal bones of the first row, the Scaphoid, Semilunar, and Cuneiform, are joined by Interosseous Lig'ts. A single segment is thus formed with continuous articular surfaces above and below.

Superiorly, the Scaphoid and Semilunar articulate with the Inf. surface of the Radius. The Cuneiform articulates with the Triangular Fibro-cartilage. There is a closed synovial sack between the Inf. surface of the Head of the Ulna and the Triangular Fibro-cartilage. Another larger sack serves for the Radio-Carpal Joint.

Type of Joint:—This may be considered to be either Ginglymus or Condyloid.

II. The Intracarpal

Inferiorly, the articular surface formed by the bones of the upper row is first convex, then concave. The Inf. surface of the Scaphoid makes up the convexity. It articulates with the Trapezium and Trapezoid.

The concavity is made up by the Int. surface of the Scaphoid and the Inf. surfaces of the Semilunar and Cuneiform. The Head of the Os Magnum, and the Sup. surface of the Unciform are received by it.

Type of Joint:—Arthrodial.

III. The Carpo-Metacarpal

The articulation between the Inf. surface of the Trapezium and the First Metacarpal, although a Carpo-Metacarpal Joint, has a synovial sack of its own, and is a different and practically distinct type of joint.

The continuous facet upon the Int. surface of the Trapezium and the Inf. surfaces of the Trapezoid, Os Magnum, and Unciform, articulates with the bases of the other four Metacarpals. A single synovial sack serves for both the Intracarpal and this larger part of the Carpo-Metacarpal Joint.

Type of Joint:—Arthrodial.

Ligaments

While often given separate descriptions, the ligaments connecting these three parts of the Wrist-Joint are really divisions of a single capsule, and are here given as such.

Capsular

This single structure passes from the forearm to the bases of the Metacarpals, attaching to the Carpals as it passes down.

Five strengthening bands are described:—

1. **Anterior**:—Attaches, above, to the Ant. margin of the lower extremity of the Radius, to its Styloid Process, and to the Head of the Ulna. It attaches first to the Scaphoid, Semilunar, and Cuneiform, then to the Trapezium, Trapezoid, Os Magnum, and ends finally on the bases of the Metacarpals.

2. **Posterior**:—Attaches, posteriorly, to the same parts of the Radius and Ulna. Passes down, giving similar slips to the same Carpal bones, and ends, posteriorly, on the bases of the Metacarpals.

3. **Internal Lateral**:—This ligament attaches, above, to the Styloid Process of the Ulna, passes to the Cuneiform, and ends by attaching to the Ulnar side of the Fifth Metacarpal.

4. **External Lateral**:—Attaches, above, to the Styloid Process of the Radius. Passes on to the outer side of the Scaphoid, then goes to the Trapezium, and finally ends by becoming continuous with capsule of the Carpo-Metacarpal Joint of the thumb.

5. **Dorsal Transverse Ligament**:—Formed by the upper fibres of the Post. Lig't, passing transversely from the Styloid process of the Radius to the Cuneiform.

The Pisiform-Cuneiform Joint

The articular facet on the Post. surface of the Pisiform articulates with a similar facet on the Ant. surface of the Cuneiform.

Ligament

1. **Capsular.**

Type of Joint:—Arthrodial.

Articulation of the Trapezium with the First Metacarpal

The saddle-shaped facet on the Inf. surface of the Trapezium articulates with a similar facet on the Sup. surface of the First Metacarpal.

Ligament

1. **Capsular.**

Type of Joint:—Saddle-joint, or Joint by Reciprocal relation.

Intermetacarpal Articulations

The lateral facets upon the Metacarpals articulate with one another.

Ligaments

1. **Anterior**:—Pass transversely from one bone to another.
2. **Posterior**:—Similar.
3. **Interosseous Ligaments**:—Pass between the adjacent surfaces just below the articular facets.

Type of Joints:—Arthrodial.

Metacarpo-Phalangeal Articulations

The Heads of the Metacarpals articulate with the bases of the Phalanges.

Ligaments

1. **Capsular:**—Attached to both bones around the margins of the articular surfaces.

Lateral thickenings form the **Int.** and **Ext. Lig'ts.**

The Ant. Lig'ts., or **Glenoid Cartilages,** fasten to the bases of the Phalanges, and loosely to the Metacarpals. These cartilages form the beginnings of the canals for the flexor tendons. In the thumb, the Glenoid Cartilage is small. The Sesamoid bones upon the Head of the First Metacarpal are joined by transverse ligamentous fibres and answer the same purpose. The four inner Glenoid Cartilages are attached to one another by the Ant. Transverse Metacarpal Lig't.

Type of Joints:—Ginglymus.

Interphalangeal Joints

Differ from the Metacarpo-Phalangeal only in the shape of their articular surfaces and the strength of their ligaments.

The Glenoid cartilages are small.

Type of Joints:—Ginglymus.

THE OS INNOMINATE

Consists of three bones fused together; the Ilium, Ischium, and Pubis. With its fellow and the Sacrum it forms the Pelvic Girdle.

ILIUM

The upper bone of the Innominate. Flat and leaf-like.

Four Borders:—
- Superior
- Inferior
- Anterior
- Posterior

Two Surfaces:—
- Internal
- External

Borders

Superior, or Crest:—Convex, doubly curved, and longest. Extends from the Ant. Sup. Spine to the Post. Sup. Spine. It has two lips and an intervening space.

Int. Lip:—In the Ant. half gives origin to the **Transversalis M.**, and, following this, to the **Quadratus Lumborum** and **Erector Spinae M. (Extensor Dorsi Communis)**. Throughout its entire extent this lip attaches the **Iliac Fascia.**

Intervening Space:—Gives origin to the **Internal Oblique M.**

Ext. Lip:—From before backward, is found the origin of the **Tensor Fasciae Latae (Tensor Vaginae Femoris)**, a partial insertion of the **External Oblique,** and a partial origin of the **Latissimus Dorsi M.** The entire lip attaches the **Fascia Lata.**

Inferior:—Anteriorly, this border fuses with the Horizontal Ramus of the Pubis. In the Acetabulum it joins the Ischium. Posteriorly, it is free, and forms the upper margin of the Great Sacro-Sciatic Notch, attaching part of the origin of the **Pyriformis M.**

Anterior:—Concave, then convex. Extends from the Ant. Sup. Spine to the Ilio-pubic (Ilio-pectineal) Eminence. It presents for examination:

1. *Ant. Sup. Spine:*—Attaches **Poupart's Lig't.**, and gives partial origin to the **Tensor Fasciae Latae** and **Sartorius M.**

2. *Sup. Iliac Notch:*—Continues the origin of the **Sartorius M.**

3. *Ant. Inf. Spine:*—Attaches the **Ilio-Femoral Lig't. (Y Lig't. of Bigelow)**, and gives origin to the **Straight Head** of the **Rectus Femoris M.**

4. *Inf. Iliac Notch:*—Transmits the **Iliacus M.**

Posterior:—Concave. Passes from the Post. Sup. Spine to the upper margin of the Great Sacro-Sciatic Notch and presents:—

1. *Post. Sup. Spine:*—Gives partial origin to the **Erector Spinae M.**

2. *Post. Iliac Notch.*

3. *Post. Inf. Spine.*

Surfaces

Internal, or Ventral:—Limited below by the Ilio-pectineal Eminence and Line. It shows:—

1. An anterior smooth area, the Iliac Fossa, giving origin to the **Iliacus M.** Between the Ant. Inf. Spine

and the Ilio-pectineal Eminence a broad groove, terminating in the Ant. Inf. Iliac Notch, transmits the tendon of the **Iliacus M.**

2. A posterior rough area, divided into two parts.

A. Anteriorly and inferiorly, the ridged, **Auricular** (ear-shaped) **surface** for articulation with the Sacrum. The indistinct Prearticular Groove separates this area from the Iliac Fossa, and attaches the **Ant. Sacro-Iliac Lig't.**

B. Posteriorly, a non-articular portion bearing an eminence, the **Tuberosity** of the Ilium. It gives attachment above, to the **Ilio-Lumbar Lig't.**; below, to the **Post. Sacro-Iliac Lig't.**; and, by a smooth surface extending from the Crest, to part of the origin of the **Erector Spinae M.**

External, or Dorsum:—Exhibits three curved lines or ridges.

1. *Superior*:—Shortest. Arises from the Ext. Lip of the Crest, about one and a half inches anterior to the Post Sup. Spine, and runs toward the Post. Inf. Spine, fading out as it nears it. Above the line from a rough area, the **Gluteus Maximus M.** takes partial origin.

2. *Middle*:—Longest. Begins on the Crest two inches behind the Ant. Sup. Spine, and runs to the inner margin of the Great Sacro-Sciatic Notch. Between the superior and middle curved lines arises the **Gluteus Medius M.**

3. *Inferior*:—Indistinct. Extends from a little above the Ant. Inf. Spine to the inner margin of the Great Sacro-Sciatic Notch. Between the middle and Inf.

curved lines arises the **Gluteus Minimus M.** Anteriorly, between the Inf. curved lines and the Acetabulum, a slight depression gives origin to the **Reflected Head** of the **Rectus Femoris M.** The lower part of the Ext. surface contributes one-fifth to the Acetabulum.

SUMMARY OF ILIUM

Borders

Superiorly:—Origin Tensor Fasciae Latae.
" Transversalis.
Insertion External Oblique.
Origin Quadratus Lumborum.
" Latissimus Dorsi.
" Erector Spinae.
Attaches Iliac Fascia and Fascia Lata.

Inferiorly:—Origin Pyriformis.

Anteriorly:—Origin Tensor Fasciae Latae.
" Sartorius.
" Straight Head Rectus Femoris.
Attaches Poupart's and Ilio-Femoral Lig'ts.

Posteriorly:—Origin Erector Spinae.

Surfaces

Internally:—Origin Iliacus from Iliac Fossa, with groove for transmission of tendon. Articulation with Sacrum by Auricular Surface.

Attachment Ilio-Lumbar and Sacro-Iliac Lig'ts.
Origin: Erector Spinae.

Externally:—Three curved lines and a depression.
Origin Gluteus Maximus.
" Gluteus Medius.
" Gluteus Minimus.
" Reflected Head Rectus Femoris.
One-fifth of the Acetabulum.

ISCHIUM

The thickest bone of the Innominate. Consists of a Body, Tuberosity, and Ramus.

Body

Three Borders:—	**Three Surfaces**:—
Superior	Internal
Internal	External
Posterior	Posterior

Borders

Superior:—Thick. Extends from the centre of the Acetabulum to the middle of the Great Sacro-Sciatic Notch. Throughout its entire extent this border is fused with the Inf. border of the Ilium.

Internal:—Sharp. Makes up the outer and part of the lower margins of the **Obturator** or **Thyroid Foramen,** and attaches the **Obturator** or **Thyroid Membrane.**

Posterior:—Extends from the upper margin of the Great Sacro-Sciatic Notch to the upper margin of the Tuberosity. It presents:

1. *Great Sacro-Sciatic Notch,* made into a **foramen** by the Lesser Sacro-Sciatic Lig't., and transmitting the **Pyriformis M.,** the **Gluteal, Sciatic,** and **Internal Pudic vessels** and **nerves,** and the **nerves** supplying the **Obturator Internus** and **Quadratus Femoris M.**

2. *Spine,* attaching the **Lesser Sacro-Sciatic Lig't.** and the **Arcus Tendineus.** Internally, it gives origin to the **Coccygeus** and **Levator Ani M.**; externally, to the **Gemellus Superior M.**

3. *Lesser Sacro-Sciatic Notch,* below the spine. The Great and Lesser Sacro-Sciatic Lig'ts. convert this notch into a **foramen** which transmits the **Internal Pudic vessels** and **nerve,** and the **nerve** to the **Obturator Internus M.** The Ext. margin of the notch gives origin to the **Gemellus Inferior M.**

Surfaces

Internal:—Smooth. Superiorly, with no distinct division, it passes over upon the Int. surface of the Ilium. Inferiorly, it is limited by the Int. border. The surface gives partial origin to the **Obturator Internus M.**

External:—Contributes the Ischial portion, about two-fifths, in the formation of the Acetabulum.

Posterior:—Four sided, and continuous with the Tuberosity. Just beneath the Acetabulum, it shows a groove which transmits the tendon of the **Obturator Externus M.**

TUBEROSITY

An enlargement of the Post. border of the Ischium receiving the weight of the body in the sitting posture. It has two poorly defined lips with a broad interspace.

Int. Lip:—Attaches the **Great Sacro-Sciatic Lig't.** and its **Falciform Process.**

Interspace:—Shows three areas. The two upper are smooth and are separated by an oblique ridge. The **inner** gives origin to the **Semitendinosus** and the **Long**

Head of the Biceps M.; the **outer** to the **Semimembranosus M.** The **third** and lower area, internally, helps attach the **Great Sacro-Sciatic Lig't.**; externally, it gives partial origin to the **Adductor Magnus M.**

Ext. Lip:—Gives origin above to the **Quadratus Femoris M.**; and below continues the origin of the **Adductor Magnus M.**

RAMUS

A narrow strip of bone ascending to join the Inf. or Descending Ramus of the Pubis.

Two Borders:—	Two Surfaces:—
Superior	Internal
Inferior	External.

Borders

Superior—Helps form the lower margin of the **Obturator Foramen**, and attaches the **Obturator Membrane.**

Inferior:—Internally, this border attaches the **Triangular Lig't.** of the Perineum; externally, the deep layer of the superficial **Perineal Fascia**, or **Colles' Fascia.** Between these layers of fascia we find, anteriorly, the attachment of the **Crus Penis (Crus Clitoris)** and the origins of the **Ischio-Cavernosus (Erector Penis)** and **Transversus Perinei M.**

Surfaces

Internal:—Smooth. Gives partial origin to the **Obturator Internus M.**

External:—Continues the origin of the **Adductor Magnus** and **Obturator Externus M.**

SUMMARY OF ISCHIUM.

Body

Superiorly:—Fusion with Ilium.

Internally:—Origin Obturator Internus and attachment of Obturator Membrane.

Externally:—Acetabulum.

Posteriorly:—1. Great Sacro-Sciatic Notch, transmitting Pyriformis M., Sciatic, Gluteal, and Int. Pudic vessels and nerves, and nerves to Obturator Internus and Quadratus Femoris M.

2. Spine:—Origin Coccygeus.
    " Levator Ani.
    " Gemellus Superior.
  Attachment Lesser Sacro-Sciatic Lig't. and Arcus Tendineus.

3. Groove for tendon Obturator Externus.

4. Lesser Sacro-Sciatic Notch, transmitting Obturator Internus M., Int. Pudic Vessels and nerve, and nerve, to Obturator Internus.
  Origin Gemellus Inferior.

Tuberosity

Internally:—Attaches Great Sacro-Sciatic Lig't.

Interspace:—Origin Semimembranosus.
  " Semitendinosus.
  " Long Head Biceps.
  " Adductor Magnus.

Externally:—Origin Quadratus Femoris.
  " Adductor Magnus.

Ramus

Superiorly:—Attaches Obturator Membrane.
" Colles' Fascia.
" Crus Penis.
Origin Ischio-Cavernosus.
" Transversus Perinei.

Internally:—Origin Obturator Internus.

Externally:—Origin Adductor Magnus.
" Obturator Externus.

PUBIS

Most anterior and smallest. Consists of a body and two prolongations, the Horizontal and Descending Rami.

Body

Quadrilateral.

Four Borders:—	Two Surfaces:—
Superior	Anterior
Inferior	Posterior
Internal	
External	

Borders

Superior:—Called the **Crest.** Begins anteriorly at a tubercle, the **Spine,** attaching the **Ext. Pillar** of the **Ext. Abdominal Ring** and **Poupart's Lig't.,** and runs transversely to the Symphysis. From the Spine inward the Crest attaches the insertion of the **Conjoined Tendon of the Internal Oblique and Transversalis M.,** and the origins of the **Rectus Abdominis** and **Pyramidalis M.** The junction of the Crest and Symphysis is called the **Angle.** It attaches the **Int. Pillar** of the **Ext. Abdominal Ring** and the **Linea Alba.**

Inferior:—An imaginary line parallel to the Crest, beginning at the lower margin of the Symphysis, where the body extends into the Descending Ramus.

Internal:—Bears, for the opposite bone, a ridged, articular surface called the symphysis, from its share in forming the **Symphysis Pubis.**

External:—An imaginary line parallel to the symphysis, running from the Spine to the Sup. border of the Descending Ramus.

Surfaces

Anterior, or external:—A rough area, internal to the Spine, gives origin to the **Adductor Longus M.** Below this the **Adductor Brevis** and **Gracilis M.** partially arise.

Posterior or Internal:—Helps form the Ant. wall of the true pelvis. Gives partial origin to the **Levator Ani M**, and attaches the **Pubo-Prostatic** (in the female, the **Pubo-Vesical) Lig'ts.**

HORIZONTAL OR SUPERIOR RAMUS

Three sided. Extends from the Body of the Pubis to the point of fusion with the Ilium, the Ilio-pectineal (Ilio-pubic) Eminence.

Three Borders:—	Three Surfaces:—
Superior	Antero-Superior
Inferior	Posterior
External	Inferior

Borders

Superior:—This border is the **Ilio-pectineal Line.** It runs from the Spine backward upon the Ilium, attaches the **Pelvic Fascia,** and forms the boundary between the false and true pelves. Anteriorly it gives partial origin to the **Pectineus M.,** and at its mid-point receives the insertion of the **Psoas Parvus M.,** when one is present.

Inferior:—Forms the upper margin of the **Obturator Foramen** and attaches the **Obturator Membrane.**

External:—Called the **Obturator Crest.** It extends from the Spine to the inner margin of the Cotyloid Notch.

Surfaces

Antero-Superior:—Contributes two-fifths to the Acetabulum and shows, just internal to this, a tuberosity, the Ilio-pectineal Eminence, marking the junction of the Ilium and Pubis. The surface gives partial origin to the **Pectineus M.**

Posterior:—Forms part of the Ant. wall of the true pelvis, and serves for part origin of the **Obturator Internus M.**

Inferior:—Shows the broad **Obturator Groove,** which forms the Sup. boundary of the Obturator Foramen, and transmits the **Obturator vessels** and **nerve.**

DESCENDING, OR INFERIOR RAMUS

Continuous with the body of the Pubis and the Ramus of the Ischium below.

Two Borders:—	**Two Surfaces:—**
Superior	Internal
Inferior	External

Borders

Superior:—Helps form the Inf. margin of the **Obturator Foramen** and attaches the **Obturator Membrane.**

Inferior:—Continuous with that of the Ischial Ramus. It attaches the **Triangular Lig't.** and **Colles' Fascia.**

Surfaces

Internal:—Gives origin, anteriorly, to the **Compressor Urethrae M.**, and, behind this, partially to the **Obturator Internus M.**

External:—Rough. Presents partial origins of the **Adductor Brevis, Gracilis, Adductor Magnus,** and **Obturator Externus M.**

SUMMARY OF PUBIS

Body

Superiorly:—	Attaches Ext. Pillar Ext. Abdominal Ring. " Poupart's Lig't.	Spine
	Insertion Conjoined Tendon. Origin Rectus Abdominus. " Pyramidalis. Attaches Int. Pillar Ext. Abdominal Ring. " Linea Alba.	Crest

Inferiorly:—Prolonged into the Descending Ramus.

Anteriorly:—Origin Adductor Longus.
“ Adductor Brevis.
“ Gracilis.

Posteriorly:—Origin Levator Ani.
Attaches Pubo-Prostatic Lig’ts.

Internally:—Prolonged into the Horizontal Ramus.

Horizontal Ramus

Superiorly:—Attaches Pelvic Fascia.
Origin Pectineus.

Inferiorly:—Transmits Obturator vessels and nerve.

Anteriorly:—Origin Pectineus.

Posteriorly:— “ Obturator Internus.

Internally:—Attaches Obturator Membrane.

Externally:—Forms Obturator Crest.

Descending Ramus

Superiorly:—Attaches Obturator Membrane.

Inferiorly:—Attaches Triangular Lig’t.
“ Colles’ Fascia.

Internally:—Origin Compressor Urethrae.
“ Obturator Internus.

Externally:—Origin Gracilis.
“ Obturator Externus.
“ Adductor Magnus and Brevis.

THE ACETABULUM

This is a partly articular cavity for the reception of the Head of the Femur, formed by the union of all the bones of the Innominate.

They contribute in the following proportions:—

Ilium sector of one-fifth.
Ischium sector of two-fifths plus.
Pubis sector of two-fifths minus.

It consists of a horseshoe-shaped articular area broken by a non-articular depression, the **Cotyloid Notch.** In the recent state the **Transverse Lig't.**, attaching to the margins of the Notch, bridges it in, and affords an unbroken articular surface.

The Cotyloid Lig't., or Cartilage, surmounts the edge of the Acetabulum except where it is broken by the Notch. This ligament simply deepens the cavity. The centre of the Acetabulum, by a rough area, the **Cotyloid Fossa,** attaches the **Ligamentum Teres.**

To distinguish between a R. and L. Innominate, place the bone with the Iliac Crest superiorly, the Acetabulum externally, and the Symphysis anteriorly.

ARTICULATIONS

With the **Sacrum, Femur,** and opposite **Pubis.**

The Synchondroses between the Ilium, Ischium, and Pubis need no discussion.

Symphysis Pubis

A rough articular area on the Int. surface of one Pubic bone, articulates with a similar area upon the other.

Ligaments

1. **Superior**
2. **Inferior**
3. **Anterior**
4. **Posterior**
5. **Interosseous Cartilage.** This fibro-cartilaginous structure forms the main tie of the joint.

A small synovial sack is usually present.

Type of Joint:—Symphysis.

THE PELVIS

This structure is divided into a false and a true portion. A plane passed from the symphysis to the promontory of the Sacrum, following the course of the Ilio-pectineal lines, marks the division.

The false pelvis lies above, and is bounded posteriorly by the two lower Lumbar Vertebrae, and laterally by the Ilia. It contains coils of the small and part of the large intestine.

The true pelvis is bounded anteriorly by the bodies, horizontal rami and symphysis of the Pubes; posteriorly, by the Sacrum and Coccyx; laterally, by the Ilia, Ischia and Horizontal and Descending Rami. Superiorly, the division between these portions is known as the Plane of Inlet of the true pelvis. Inferiorly, is found the outlet of the true pelvis. It is diamond-shaped, and is composed of two triangles, whose bases coincide at an imaginary line extending between the two Ischial tuberosities. The anterior, or urethral triangle, has its apex at the symphysis and its basal angles at the tuberosities. It is bounded laterally by the margins of the Descending and Ischial Rami, and inferiorly by the above imaginary line. In this triangle we find the urethra, and in the female the vagina, also.

The posterior, or anal triangle, has its apex at the tip of the coccyx and its basal angles at the tuberosities. It is bounded laterally, in the recent state, by the Int. margins of the Great Sacro-Sciatic Lig'ts. In it we find the Rectum.

The true pelvis is occupied by a few coils of the small intestine. the termination of the large, and the urogenital apparatus.

THE FEMUR

The thigh bone—longest in the body—presents a shaft and two extremities.

UPPER EXTREMITY

Consists of a **Head** surmounting a distinct **Neck** which springs from a thickened part of the bone bearing the **Greater** and **Lesser Trochanters.**

Head

Slightly more than a half sphere in shape. An articular surface for the Acetabulum occupies it, except at a fossa which attaches the **Ligamentum Teres.**

Neck

Makes an angle of approximately 130 degrees with the shaft.

Antero-internally, it is limited by a rough ridge, the **Anterior Intertrochanteric Line,** which is the upper termination of the **Spiral Line.** The beginning of the Line is marked by the **Sup. Cervical Tubercle,** or Tubercle of the Femur. Near the level of the Lesser Trochanter, the **Inf. Cervical Tubercle** is found. It gives partial origin to the **Vastus Externus M.** Postero-internally, an elevation, the **Post. Introchanteric Line,** bounds the Neck.

The **capsule** of the Hip-Joint attaches down the Spiral Line to the level of the Lesser Trochanter, then ascends, crossing obliquely the middle of the back of the Neck, and passes forward under the Digital Fossa, thus completing the enclosure of the Neck.

neck ant inside cap [illegible]
post ½ "

Great Trochanter

A quadrilateral eminence upon the outer side of the upper extremity. Superiorly, it shows a prominent free margin, broken by irregular depressions which give insertion to the **Obturator Internus, Sup.** and **Inf. Gemelli,** and **Pyriformis M.** Internal to this free margin is the **Digital,** or **Trochanteric Fossa,** receiving the insertion of the **Obturator Externus M.**

Inferiorly, it fades into the shaft and with it gives origin to the **Vastus Externus M.**

Posteriorly, it shows the Post. Intertrochanteric Line just below the Great Trochanter. This line presents an indistinct swelling or ridge, the **Linea Quadrati,** for insertion of the **Quadratus Femoris M.**

Externally, a diagonal ridge, extending from the postero-superior to the antero-inferior limits of the Trochanter, gives insertion to the **Gluteus Medius M.**, and divides the Trochanter into two parts:

1. Anteriorly, a depression for the insertion of the **Gluteus Minimus M.**, and behind this a smooth triangular surface, lodging a **bursa,** over which plays the tendon of the Gluteus Medius M.

2. Posteriorly, a smooth convexity, lodging a **bursa** for the tendon of the Gluteus Maximus M.

In its extreme lower part, this surface with the Inf. borders, gives partial origin to the **Vastus Externus M.**

SUMMARY OF GREAT TROCHANTER

Superiorly:—Insertion Obturator Internus.
" Gemelli.
" Pyriformis.

Inferiorly:—Origin Vastus Externus.

Posteriorly:—Linea Quadrati. Insertion Quadratus Femoris.

Internally:—Digital Fossa. Insertion Obturator Externus.

Externally:—Insertion Gluteus Minimus.
Bursal Surface (Gluteus Medius).
Insertion Gluteus Medius.
Bursal Surface (Gluteus Maximus).

Lesser Trochanter

A knob-like projection upon the Int. Surface of the upper extremity. It occurs at the intersection of three lines, the Post. Intertrochanteric, the middle prolongation of the Linea Aspera or Pectineal Line, and a rounded ridge upon the Neck. At its summit the Trochanter gives insertion to the tendons of the **Psoas Magnus** and **Iliacus M.** Some fibres of the latter are found upon the Inf. surface.

SHAFT

Cylindrical and smooth, except for a prominent ridge posteriorly, the **Linea Aspera.** For convenience in description, Ext. and Int. borders are given, though the rounded character of the shaft renders them very indistinct.

Three borders:—

- Internal
- External
- Posterior

Three surfaces:—

- Anterior
- Internal
- External

Borders

Internal:—Extends from the Inf. Cervical Tubercle to the Int. Condyle.

External:—Passes from the antero-inferior limit of the Great Trochanter to the Ext. Condyle.

Posterior:—This border is the **Linea Aspera.** It consists of two lips and an interspace.

Internal Lip:—Begins at the Inf. Cervical Tubercle as part of the Spiral Line, and passing down the shaft becomes parallel to the Ext. lip.

In the lower third it runs toward the Int. Condyle; here it is called the **Int. Supracondylar Ridge,** and is rendered indistinct by the passage of the **Popliteal vessels** and **Int. Popliteal N.** The **Vastus Internus M.** arises from the Spiral Line and the entire inner lip; the **Adductor Magnus M.** inserts upon the whole lip. The middle third gives insertion to the **Adductor Longus M.**

Interspace:—Superiorly, triangular. Shows a ridge, the **Pectineal Line,** running down from the Lesser Trochanter, for the insertion of the **Pectineus M.** In the upper third of the shaft the interspace gives insertion to the **Adductor Brevis M.**

External Lip:—Begins as a prominent line, the **Gluteal Ridge,** upon the postero-external surface of the Great Trochanter. At the level of the Lesser Trochanter a tubercle appears, often wrongly called the Third Trochanter of the Femur. The lip, or in this portion, the Gluteal Ridge, to a short distance below, gives insertion to the **Gluteus Maximus M.** Inferiorly, it becomes the **Ext. Supracondylar Ridge.** Throughout its whole extent, the lip gives origin to the **Short Head** of the **Biceps** and **Vastus Externus M.**

Surfaces

Anterior:—Convex. In the upper three-fourths gives origin to the **Crureus M.**, below this, by two or three small slips, to the **Subcrureus M.**

Internal:—Gives origin to the **Vastus Internus M.**

External:—Shows occasionally, just external to the Gluteal Ridge, the **Fossa Hypotrochanterica**, giving slight insertion to the **Gluteus Maximus M.** The upper three-fourths of this surface also gives origin to the **Crureus M.**

SUMMARY

Anteriorly:—Origin Crureus.
" Subcrureus.

Posteriorly:—Origin Vastus Internus.
Insertion Adductor Magnus.
" Adductor Longus.
" Pectineus.
" Adductor Brevis.
" Gluteus Maximus.
Origin Short Head Biceps.
" Vastus Externus.

Internally:—Origin Vastus Internus.

Externally:—Origin Crureus.

LOWER EXTREMITY

Presents for examination:—First, two **Condyles**, joined anteriorly by the Patellar Facet, a smooth trochlear surface separated posteriorly by the **Intercondylar Notch**; and second, the **Popliteal surface.**

Condyles

1. *Internal:*—Inferiorly, articulates with the Int. Tuberosity of the Tibia. Posteriorly, shows, near the termination of the Int. Supracondylar Ridge, the **Adductor Tubercle,** completing the insertion of the **Adductor Magnus M.** Below this a concavity gives origin to the **Inner Head of the Gastrocnemius M.**

Internally, shows, at the termination of the Int. Supracondylar Ridge, a tuberosity attaching the **Int. Lat. Lig't.** of the Knee-Joint.

Externally, forms the inner margin of the Intercondylar Notch, and attaches the **Post. Crucial Lig't.** of the Knee-Joint.

2. *External:*—Inferiorly, articulates with the Ext. Tuberosity of the Tibia.

Posteriorly, by a concavity gives origin to the **Outer Head of the Gastrocnemius M.** Above this a small tubercle gives origin to the **Plantaris M.**

Internally, forms the outer margin of the Intercondylar Notch, and attaches the **Ant. Crucial Lig't.**

Externally, bears superiorly a tuberosity attaching the **Ext. Lat. Lig't.** of the Knee-Joint. Below this the **Popliteal Groove** gives origin to the **Popliteus M.**

Popliteal Surface

Lies between the Supracondylar Ridges, just above the Notch and Condyles. It is covered with fat, and is traversed by the **Popliteal vessels and Int. Popliteal N.**

SUMMARY

Inferiorly:—Articulation with Tibia.

Posteriorly:—Origin Gastrocnemius. Two heads.
" Plantaris.

Internally:—Attaches Int. Lat. Lig't.
Adductor tubercle. Insertion Adductor Magnus.

Externally:—Origin Popliteus.
Attaches Ext. Lat. Lig't.

The Intercondylar Notch attaches the Ant. and Post. Crucial Lig'ts.

To tell a R. from a L. Femur, place the bone with the Head directed inward, and the Linea Aspera posteriorly.

ARTICULATIONS

With two bones, the Innominate and the Tibia.

HIP-JOINT

The Acetabulum of the Os Innominate articulates with the Head of the Femur.

Ligaments

Two merely render the Acetabulum a more perfect articular cavity. They are:—

1. **Cotyloid**:—Attaches to the rim of the Acetabulum, except where it is interrupted by the Cotyloid Notch, and serves to deepen the socket.

2. **Transverse**:—Passes between the margins of the Cotyloid Notch, thus forming a continuous articular surface.

Two connect the bones. They are:—

1. **Ligamentum Teres:**—Weak. Passes between the centre of the Acetabulum and the oval fossa upon the Head of the Femur. It lies outside the synovial membrane.

2. **Capsular:**—Attaches superiorly around the rim of the Acetabulum, reaching the Ant. Inf. Spine in its upward extension, and to the Cotyloid and Transverse Lig'ts. Inferiorly, it attaches down the Spiral Line to the level of the Lesser Trochanter, then ascends, crossing obliquely the middle of the back of the Neck, and passes once more to the Sup. Cervical Tubercle. The posterior attachment upon the Neck is not strong.

Three strengthening bands are described:—

1. **Ilio-femoral,** or **Y. Lig't. of Bigelow:**—Triangular, with its apex attached to the Ant. Inf. Spine and bone immediately below it, and with its arms finding attachment upon the Spiral Line to the level of the Lesser Trochanter.

2. **Pubo-femoral:**—A narrow thickening passing from the Obturator Crest to the Spiral Line at the level of the Lesser Trochanter.

3. **Ischio-femoral:**—Passes from the Post. margin of the Acetabulum to the top of the Digital Fossa.

Type of Joint:—Enarthrosis.

PATELLA

Triangular in shape. The largest sesamoid bone in the body. It develops in the tendon of the Quadriceps Extensor M.

Three borders:—	**Two surfaces:—**
Superior	Anterior
Internal	Posterior
External	

Superior:—Attaches the tendon of the **Quadriceps Extensor,** composed of four muscles, which thus find a common attachment to the Patella, viz., Rectus Femoris, Vastus Internus, and Externus, and Crureus.

Internal and External:—Attach the **Quadriceps Extensor M.**

Surfaces

Anterior:—Convex and studded with foramina. It is covered by the expanded tendon of the Quadriceps Extensor M., and below gives attachment to the **Ligamentum Patellae.**

Posterior:—Presents:—1. Articular area for the Trochlear surface of the Femur. The **Capsule** of the Knee-Joint attaches around this area.

2. Inferior non-articular portion attaching the **Ligamentum Patellae.**

To tell R. from L. Patella, place apex downward and have the broader part of the articular area external.

Articulations

With the Femur only, as part of the Knee-Joint.

TIBIA

The inner bone of the leg. Presents a shaft and two extremities.

UPPER EXTREMITY

Shows **two tuberosities** and a **tubercle.**

Internal Tuberosity:—Superiorly, bears a kidney-shaped condylar surface for articulation with the Int. condyle of the Femur. This surface shows, following its Int. circumference, a flat area, wider at the back than in front, which supports the **Int. semilunar cartilage,** attached by the **Int. Coronary Lig't.** to the margin of the facet.

Internally, the tuberosity is rough and convex. With the upper Int. surface of the shaft it attaches the **Int. Lat. Lig't.** of the Knee-Joint.

Posteriorly, a horizontal groove gives insertion to the **Semimembranosus M.**

External Tuberosity:—Superiorly, bears a circular condylar facet for articulation with the Ext. condyle. Around its Ext. margin this facet attaches the **Ext. Coronary Lig't.,** and just internal to this attachment it supports the **Ext. semilunar cartilage.**

Externally, it is rough and convex. At the level of the Tubercle and just posterior to it, we find partial origin of the **Tibialis Anticus** and **Extensor Longus Digitorum M.,** followed by a small insertion of the **Biceps M.,** and a circular **facet** for articulation with the Head of the Fibula.

The Tuberosities are separated by a rough non-articular area presenting the **Spine**, and deepening posteriorly into the **Popliteal Notch** which transmits the **Popliteal vessels** and **Int. Popliteal N.** In front of the Spine, we have the attachment of the **Ant. Crucial Lig't.**; posterior to it, in the Popliteal Notch, the attachment of the **Post. Crucial Lig't.** The **Ant. horns** of the **Ext.** and **Int. semilunar cartilages** attach in front of the Spine, their **Post.** horns behind it.

Tubercle:—A dull prominence upon the Ant. aspect of the upper extremity. Superiorly, a smooth surface bears a bursa. Below this a rough area gives attachment to the **Ligamentum Patellae**, the extension of the tendon of the Quadriceps Extensor M. The actual insertion of this muscle is therefore upon the Tibia.

SUMMARY

Superiorly:—Two condylar articular surfaces.
Attaches Int. and Ext. Coronary Lig'ts.
" Int. and Ext. semilunar cartilages.
" Ant. and Post. Crucial Lig'ts.
Supports Semilunar Cartilages.

Anteriorly:—Tubercle, bursa, and attachment Ligamentum Patellae.

Internally:—Attaches Int. Lat. Lig't.
Insertion Semimembranosus.

Externally:—Origin Extensor Longus Digitorum.
Insertion Biceps.
Articular facet for Fibula.

SHAFT

Triangular.

Three borders:—	**Three surfaces:—**
Anterior	Internal
Internal	External
External	Posterior

Borders

Anterior:—Subcutaneous. Called the **Crest** or **Shin.** Extends from the Tubercle to the Int. Malleolus and attaches the **deep fascia** of the leg.

Internal:—Passes from the Post. aspect of the Int. Tuberosity to the back of the Int. Malleolus. The middle third gives partial origin to the **Soleus M.**

External, or **Interosseous Border:**—Begins upon the middle of the Ext. Tuberosity, and extends to the lower extremity, where it splits to enclose a triangular rough area. The border attaches the **Interosseous Membrane,** a structure similar to the one connecting the Radius and Ulna.

Surfaces

Internal:—Included between the Ant. and Int. Borders.

Superiorly, it attaches the **Int. Lat. Lig't.** of the Knee-Joint. From the level of the Tubercle, extending a short distance down the shaft, we find the horseshoe-shaped insertion of the **Sartorius M.,** enclosing the insertions of the **Gracilis** and **Semitendinosus M.** The rest of the surface is subcutaneous.

External:—The upper two-thirds shows a depression for the origin of the **Tibialis Anticus M.** Over the lower portion pass the extensor tendons.

Posterior:—Limited by the Int. and Ext. borders.

Superiorly, it is crossed from without inward by the **Oblique Line,** which joins the Int. border, and with it gives origin to the **Soleus M.** Above the line a triangular area receives the insertion of the **Popliteus M.** Below it, a poorly marked vertical ridge divides the surface into two parts; an internal for the origin of the **Flexor Longus Digitorum M.** and an external for the **Tibialis Posticus M.** The lower part of the surface is smooth and covered by the flexor tendons.

SUMMARY

Anteriorly:—Attaches deep fascia.
Posteriorly:—Insertion Popliteus.
Origin Soleus.
" Flexor Longus Digitorum.
" Tibialis Posticus.

Internally:—Attaches Int. Lat. Lig't.
Insertion Sartorius.
" Gracilis.
" Semitendinosus.
Origin Soleus.

Externally:—Attaches Interosseous Membrane.
Origin Tibialis Anticus.

LOWER EXTREMITY

Roughly quadrilateral.

Inferiorly, shows a concave surface for articulation with the Astragalus.

Anteriorly, a rough border attaches the **Ant. Lig't.** of the Ankle-Joint.

Posteriorly, a similar border attaches the **Post. Lig't.** Upon the Malleolus there is a **broad groove** for the passage of the tendons of the **Tibialis Posticus** and **Flexor Longus Digitorum M.** External to this, another, poorly marked, transmits the **Flexor Longus Hallucis M.**

Internally, we have the **Int. Malleolus,** a subcutaneous structure, articulating by its outer surface with the Astragalus, and upon its tip and Post. border giving attachment to the **Int. Lateral** or **Deltoid Lig't.** of the Ankle-Joint.

Externally, a rough triangular area articulates with the Tibia and attaches the **Interosseous Lig't.** of the Inf. Tibio-fibular Joint.

To tell a R. from a L. Tibia, place the bone with the Int. Malleolus internally and pointing downward, and have the Tubercle anteriorly.

ARTICULATIONS

With three bones, the **Femur, Fibula,** and **Astragalus.**

KNEE JOINT

The Condyles of the Femur, by their Inf. Surfaces, articulate with the condylar facets upon the Sup. Surfaces of the Tuberosities of the Tibia; and the Trochlear surface of the Femur articulates with the Post. surface of the Patella.

Ligaments

1. **Capsular:**—Attached as follows:

a. Attachment to the Femur.

Anteriorly, above the articular surface.

Posteriorly, crosses above the condyles, dipping a little at the Intercondylar Notch.

Laterally, from the sides and tuberosities of the condyles.

b. Attachment to the Tibia.

All around slightly below the Sup. surface.

Anteriorly, the capsule attaches around the articular surface of the Patella.

Three thickenings of the capsule are described:—

A. **Ligament of Winslow**:—Formed by the tendon of insertion of the Semimembranosus M. Extends transversely from the point of origin of the Outer Head of the Gastrocnemius to the insertion on the Tibia of the Semimembranosus.

B. **Internal Lateral**:—Extends from the tuberosity upon the Int. Condyle of the Femur to the inner surface of the Int. Tuberosity and upper two inches of the shaft of the Tibia.

C. **External Lateral**:—This is practically a distinct ligament. It runs from the outer tuberosity of the Femur to the Ext. surface of the Ext. Tuberosity of the Tibia, splitting in its lower part to enclose the tendon of the Biceps M. Posteriorly, a short slip of this ligament may be artificially traced to the Styloid Process of the Fibula, and is known as the Short Ext. Lat. Lig't.

2. **Int. Semilunar Cartilage**:—One of two crescentic interarticular structures which deepen the shallow facets upon the Sup. surfaces of the Tibia, and accommodate them for the proper reception of the condyles of the Femur. It has two horns, an anterior, attaching in front of the Tibial Spine, and a posterior, attaching immedi-

ately behind it. The periphery is bound to the capsule and Tibia by the Int. Coronary Lig't.

3. **Ext. Semilunar Cartilage:**—Has practically the same relative attachments.

4. **Int. Coronary:**—A weak thickening of the capsule, attaching to it the semilunar cartilage and holding this in place upon the condylar surface.

5. **Ext. Coronary:**—Relatively the same.

6. **Transverse:**—A small inconstant band, connecting the Ant. horns of the semilunar cartilages.

7. **Anterior Crucial:**—Extends from the Int. margin of the Ext. condyle to the front of the Tibial Spine.

8. **Posterior Crucial:**—Extends from the Ext. margin of the Int. condyle to the Popliteal Notch.

9. **Ligamentum Patellae:**—Extends from the apex of the Patella to the Tubercle of the Tibia. Beneath this ligament, filling up the space between the Femur, Tibia, and Patella, is found the Subpatellar Pad of fat. It is lined by synovial membrane.

10. **Ligamentum Mucosum:**—Passes from the top of the Intercondylar Notch to the Subpatellar Pad, being merely an extension of its synovial membrane.

11. **Ligamenta Alaria:**—Two in number. They are the fringed edges of the Ligamentum Mucosum.

Nine bursae are found in connection with this joint.

Type of Joint:—Condylarthrosis in slight flexion; Ginglymus in extreme flexion.

FIBULA

The outer bone of the leg. Presents for examination a **shaft** and **two extremities.**

UPPER EXTREMITY

Known as the **Head.** Superiorly it bears a round facet for articulation with the Tibia. Anterior to this facet, it gives insertion to the **Biceps M.** The **Styloid Process** is a pointed projection upon the outer side. It attaches the short slip of the **Ext. Lat. Lig't.** of the Knee-Joint, and the insertion of the **Biceps M.**

The **Capsule** of the Sup. Tibio-Fibular joint attaches around the articular facet.

SHAFT

Shows four borders and four surfaces.

Borders:—	**Surfaces:—**
Antero-External	Anterior
Antero-Internal	Internal
Postero-Internal	Posterior
Postero-External	External

Borders

Antero-External:—Begins as a dull ridge a little below the head, and soon becomes prominent and sharp. In the lower fourth it bifurcates to enclose the **Ext. Malleolus.**

Antero-Internal, or **Interosseous:**—Arises in common with the preceding, and running parallel to it down the shaft, splits near the lower extremity to enclose a rough triangular area articulating with the Tibia. The entire border attaches the **Interosseous Membrane.**

Postero-Internal:—Extends from the back of the head to its junction with the Antero-Internal, three-fourths of the way down the shaft. It is often called the **Oblique Line** of the Fibula, and when so, the bone is described as having three borders and three surfaces.

Postero-External:—Begins below the Styloid Process and twists backward, ending upon the Post. aspect of the Malleolus.

Surfaces

Anterior:—Very narrow. Included between the Antero-Internal and Antero-External borders. Superiorly, it gives partial origin to the **Extensor Longus Digitorum M.**; in its middle two-fourths, to the **Extensor Longus Hallucis M.**, and in the lower fourth, to the **Peroneus Tertius M.**

Internal:—Lies between the Antero-Internal and Postero-internal borders. Gives partial origin to the **Tibialis Posticus M.**

Posterior:—Limited by the postero-internal and postero-external borders. Its upper fourth, by a slightly rough area, gives partial origin to the **Soleus M.**; the middle two-fourths, to the **Flexor Longus Hallucis M.**

External or **Peroneal:**—Bounded by the Antero-External and postero-external surfaces. A concave area superiorly gives origin to the **Peroneus Longus M.** Below this from a convexity arises the **Peroneus Brevis M.**

SUMMARY OF THE SHAFT

Anteriorly:—Origin Extensor Longus Digitorum.
" Extensor Longus Hallucis.
" Peroneus Tertius.
Internally:—Attaches interosseous Membrane.
Origin Tibialis Posticus.
Posteriorly:—Origin Soleus.
" Flexor Longus Hallucis.
Externally:—Origin Peroneus Longus.
" Peroneus Brevis.

LOWER EXTREMITY

Presents two surfaces and forms the **Ext. Malleolus,** the lower of the two malleoli.

Int. Surface:—Shows superiorly a rough triangular surface for articulation with the Tibia and attachment of the **Interosseous Lig't.** of the Inf. Tibio-Fibular Joint, and below this a quadrant-shaped surface for the Astragalus. Posterior to this facet, is the deep **Digital Fossa,** attaching the **Post. Band** of the **Ext. Lat. Lig't.** of the Ankle Joint and the **Transverse Lig't.** of the Inf. Tibio-Fibular Joint.

Ext. Surface:—Convex and subcutaneous. Upon its Ant. border it attaches the **Ant. Band** of the **Ext. Lat. Lig't.,** and near the tip of the Malleolus the **Mid. Band.**

To tell a R. from a L. Fibula place the Styloid Process superiorly and externally, and have the Digital Fossa looking backward.

ARTICULATIONS

With two bones, the **Tibia** and **Astragalus.**

THE SUPERIOR TIBIO-FIBULAR JOINT

The round facet upon the Ext. Tuberosity of the Tibia articulates with a similar facet upon the Head of the Fibula.

Ligaments

Capsular:—Attaches around the articular surfaces. Externally, it joins the Ext. Lat. Lig't. of the Knee-Joint. Two strengthening bands are present.

1. **Ant. Sup. Tibio-Fibular:**—Passes from the Ext. Tuberosity downward upon the head of the Fibula.
2. **Post. Sup. Tibio-Fibular:**—Same relative attachments.

Type of Joint:—Arthrodial.

THE INFERIOR TIBIO-FIBULAR JOINT

The rough triangular area upon the Int. surface of the lower extremity of the Fibula articulates with a corresponding surface upon the Tibia.

Ligaments

1. **Interosseous:**—A continuation of the membrane, consisting of short fibres uniting the opposed surfaces.
2. **Ant. Inf. Tibio-Fibular:**—Passes between the antero-internal angle of the lower extremity of the Tibia and the Ant. surface of the Ext. Malleolus.
3. **Post. Inf. Tibio-Fibular:**—Same relative attachments.
4. **Transverse:**—Extends from the Post. borders of the Int. Malleolus and Inf. extremity of the Tibia to the Digital Fossa of the Fibula.

Type of Joint:—Syndesmosis.

THE FOOT

Like the hand, the foot consists of three groups of bones, the **Tarsus, Metatarsus,** and **Phalanges.**

THE TARSUS

Seven bones make up this group. All have six surfaces. No borders are described. Fairly movable joints lie between them giving the Tarsus a certain pliability. Its integrity as a single structure is maintained by innumerable ligaments. Some are large and distinct enough to merit attention. Many others are named, but are largely artificial separations from the general Dorsal, Plantar, and Interosseous bindings, which characterize the foot, as well as the hand. We will mention only those of importance.

CALCANEUM OR OS CALCIS

The heel bone and largest of the Tarsus.

Surfaces

Superior:—Just above the Ant. facet a rough ridge attaches dorsal Lig'ts., and gives origin to the **Extensor Brevis Digitorum M.** Behind this lies a deep depression for ligaments, the **Sinus Pedis** (Sinus Tarsi). As a deep groove it runs back and in, attaching the **Astragalo-Calcanean Interosseous Lig't.,** and separating two facets.

Facets:—1. Anterior, long and narrow. Extends from middle of Sustentaculum Tali to front of bone.

2. Posterior:—Convex and in outline a trapezoid. Both articulate with the Astragalus. Behind the Post. facet a rough convex surface lodges a mass of fat.

SUMMARY

Origin:—Extensor Brevis Digitorum.
Sinus Pedis.
Attachment: — Astragalo-Calcanean Interosseous Lig't
Two Facets.

Inferior:—Concave. Anteriorly, a tubercle attaches the **Short Plantar Lig't.** Behind this a rough surface attaches the **Long Plantar Lig't.** which springs also from the concavity immediately before the tuberosities where the **Outer Head** of the **Accessorius M.** arises.

Posteriorly, are two tuberosities separated by a groove.

Int. Tuberosity:—Larger. Gives origin to the **Abductor Hallucis,** and **Flexor Brevis Digitorum M.**

Groove:—Attaches **Plantar Fascia.**

Ext. Tuberosity:—Small. Gives origin to the **Abductor Minimi Digiti M.**

An occasional slip inserting separately is called the Abductor Ossis Metatarsi Quinti.

SUMMARY

Attachment:—Short and Long Plantar Lig'ts.
Origin:—Outer Head Accessorius.
Int. Tuberosity:—Origin Abductor Hallucis.
" Flexor Brevis Digitorum.
Interspace:—Plantar Fascia.
Ext. Tuberosity:—Origin Abductor Minimi Digiti.

Anterior:—Bears a convex facet for articulation with the Cuneiform.

Posterior:—An oval convexity, smooth above for a **bursa**, and rough below for the insertion of the **Tendo Achillis** (Soleus and Gastrocnemius).

Internally, and with this insertion, occurs that of the **Plantaris M.**

Internal:—Smooth and concave. Antero-superiorly shows a process, the **Sustentaculum Tali,** attaching the **Inf. Calcaneo-Scaphoid,** or **Spring Lig't.,** the **Int. Lateral,** or **Deltoid Lig't.,** and a partial insertion of the **Tibialis Posticus M.**

A narrow groove beneath the Sustentaculum Tali transmits the tendon of **Flexor Longus Hallucis.** Below this from a broad groove transmitting the **Plantar Vessels and Nerves,** arises the **Inner Head** of the **Accessorius M.**

SUMMARY

Sustentaculum Tali.
Attachment:—Spring and Deltoid Lig'ts.
Insertion:—Tibialis Posticus.
Two Grooves:—
    Upper, transmits Flexor Longus Hallucis.
        "   origin Inner Head Accessorius.
    Lower, transmits Plantar Vessels and Nerves.

External:—In line with the notch for the Sinus Pedis upon the Sup. surface is found a small tubercle, the **Peroneal Spine** (ridge) which separates two grooves. The Supero-anterior transmits the tendon of the **Per-**

oneus Brevis; the infero-posterior, the tendon of the **Peroneus Longus.** Behind this groove a dull prominence, often mistaken for the Peroneal Spine, attaches the **Middle Band** of the **Ext. Lat. Lig't.** of the ankle-joint.

SUMMARY

Attachment:—Middle Band Ext. Lat. Lig't.
Upper Groove:—Transmits Peroneus Brevis.
Peroneal Spine.
Lower Groove:—Transmits Peroneus Longus.

The Calcaneum articulates with two bones, the **Astragalus** and **Cuboid.**

CUBOID

Surfaces

Superior and External:—These form a continuous non-articular area, rough for ligamentous attachments, and broken externally by the commencement of the Peroneal Groove.

Inferior:—Anteriorly the **Peroneal Groove** transmits the tendon of the **Peroneus Longus M.** A ridge, the promontory, or tuberosity of the Cuboid, forms its Post. lip. This partially attaches the **Long Plantar Lig't.**, and externally has a facet for articulation with the Sesamoid Bone in the tendon of the Peroneus Longus. Behind the ridge a rough concave area attaches the **Short Plantar Lig't.** and an insertion of the **Tibialis Posticus M.** Adjacent to the posterior margin of the Ext. Cuneiform it gives partial origin to the **Flexor Brevis Hallucis M.**

Anterior:—Articulates by two facets with the fourth and fifth Metatarsals.

Posterior:—Also entirely articular, fitting the Ant. facet of the Calcaneum.

Internal:—Largely rough for the **Cubo-Scaphoid Interosseous Lig't.** An oblong facet for the Ext. Cuneiform occupies the Mid. and Sup. portions. Behind this lies a small inconstant facet for articulation with the Scaphoid.

SUMMARY

Articulates with four bones, the **4th** and **5th Metatarsals, Ext. Cuneiform,** and **Calcaneum,** and occasionally the **Scaphoid.**

Attachments

Ligamentous:—Cubo-Scaphoid Interosseous and Long and Short Plantars.

Muscular:—Insertion:—Tibialis Posticus.
Origin:—Flexor Brevis Hallucis.

Transmission:—Tendon Peroneus Longus.

ASTRAGALUS OR TALUS

An irregular bone, forming the keystone of the Longitudinal Arch of the foot, and presenting for study a Body, Neck and Head.

BODY

Surfaces

Superior:—Shows posteriorly, a four-sided trochlear surface for articulation with the Tibia.

Inferior:—A large concave facet articulates with the Calcaneum. Anterior to this, a groove widening externally attaches the **Astragalo-Calcanean Interosseous Lig't.,** and forms the roof of the Sinus Pedis.

Anterior:—Imaginary. Joins neck.

Posterior:—That part behind the trochlear surface. Shows two tubercles separated by a groove which transmits the tendon of the **Flexor Longus Hallucis.** The Ext. tubercle is often separate, and is called the **Os Trigonum.**

Internal:—Superiorly a narrow triangular facet articulates with the Int. Malleolus. A depression below this attaches the deep portion of the **Int. Lat.** or Deltoid Lig't.

External:—A quadrant-shaped facet articulates with the Ext. Malleolus. Anterior, and posterior to this are depressions for the **Ant.** and **Post. Bands** of the **Ext. Lat. Lig't.** of the ankle-joint.

NECK

A slight constriction which connects the Body and Head and superiorly attaches the Ant. part of the **capsule** of the ankle-joint.

HEAD

Anteriorly, a smooth convex surface articulates with the Scaphoid, infero-internally, an oblong one with the Sustentaculum Tali. Between these is a third, made smooth by the gliding of the Inf. Calcaneo-Scaphoid Lig't.

SUMMARY

Articulates with four bones, the **Tibia, Fibula, Calcaneum,** and **Scaphoid.**

Attachments

Ligamentous:—Astragalo-Calcanean Interosseous.
Int. Lateral.
Ant. and Post. Bands Ext. Lateral.
Transmission:—Tendon Flexor Longus Hallucis.

SCAPHOID OR NAVICULAR

A concavo-convex dish, roughly boat shaped.

Surfaces

Superior:—Convex and rough for ligamentous attachments.

Inferior:—Concave and rough for ligamentous attachments.

Anterior:—Bears three triangular facets for articulation with the three Cuneiforms.

Posterior:—Completely occupied by a concave facet articulating with the Astragalus.

Internal:—Rough. At the junction with the inferior it presents the **Tuberosity** of the Scaphoid attaching the **Inf. Calcaneo-Scaphoid Lig't.** and the main insertion of the **Tibialis Posticus M.** This Tuberosity is occasionally separate, and is known as the **Tibiale Externum.**

External:—Rough, attaching the **Cubo-Scaphoid Interosseous Lig't.** Sometimes has a small facet for articulation with the Cuboid.

SUMMARY

Articulates with four bones, the **three Cuneiforms** and **Astragalus.** Occasionally it meets the Cuboid, and still less often the Calcaneum.

Attachments

Ligamentous:—Cubo-Scaphoid Interosseous.
Inf. Calcaneo-Scaphoid.

Muscular:—Insertion Tibialis Posticus.

INTERNAL CUNEIFORM

The largest of the three. Wedge shaped, with edge upward.

Surfaces

Superior:—Simply a rough ridge, attaching ligaments.

Inferior:—Anteriorly, gives partial insertion internally to the **Tibialis Anticus M.**; externally to the **Peroneus Longus M.**; Posteriorly an eminence receives an insertion of the **Tibialis Posticus M.**

Anterior:—By a kidney-shaped facet articulates with the first Metatarsal.

Posterior:—A triangular facet articulating with the Scaphoid.

Internal:—Rough for ligamentous attachment. Infero-anteriorly a small bursal surface underlies the tendon of the Tibialis Anticus M.

External:—Shows an L shaped facet articulating anteriorly with the second Metatarsal, posteriorly, with the Middle Cuneiform. The rest of the surface is rough for ligaments.

SUMMARY

Articulates with four bones, the **1st and 2nd Metatarsals, Scaphoid** and **Middle Cuneiform.**

Attachments

Muscular:—Insertion Tibialis Anticus.
Insertion Peroneus Longus.
Insertion Tibialis Posticus.

MIDDLE CUNEIFORM

Smallest and shortest of the three. Has the edge of the wedge down.

Surfaces

Superior:—Rough, attaching ligaments.

Inferior:—A ridge which gives a slight insertion to the **Tibialis Posticus M.** and attaches ligaments.

Anterior:—Articulates, by a convex facet with the second Metatarsal.

Posterior:—Concave and larger than the anterior. This facet articulates with the Scaphoid.

Internal:—Has an L shaped facet for articulation with the Int. Cuneiform.

External:—A vertical facet articulates with the Ext. Cuneiform.

SUMMARY

Articulates with four bones, the **2nd Metatarsal, Scaphoid, Int.** and **Ext. Cuneiforms.**

Attachments

Muscular:—Insertion Tibialis Posticus.

EXTERNAL CUNEIFORM

Intermediate in size. The wedge points downward.

Surfaces

Superior:—Rough for ligamentous attachment.

Inferior:—Rough. Attaches ligaments, an origin of the **Flexor Brevis Hallucis** and an insertion of the **Tibialis Posticus M.** This muscle has therefore been seen to insert upon all the Tarsal bones except the Astragalus.

Anterior:—Shows a triangular facet articulating with the third Metatarsal.

Posterior:—By a convex oblong facet articulates with the Scaphoid.

Internal:—Posteriorly, a large triangular facet articulates with the Middle Cuneiform. Along the Ant. margin, a narrow facet articulates with the second Metatarsal.

External:—Anteriorly, a vertical facet articulates with the inner side of the base of the fourth Metatarsal. Posteriorly, an irregular facet articulates with the Cuboid.

SUMMARY

Articulates with six bones, the **2nd, 3rd** and **4th Metatarsals, Scaphoid, Middle Cuneiform,** and **Cuboid.**

Attachments

Muscular:—Origin Flexor Brevis Hallucis.
Insertion Tibialis Posticus.

THE METATARSUS

Consists of five long bones. The posterior or proximal extremity is the base, the anterior or distal the head. They have the following common characteristics:—

Bases

Superiorly and inferiorly, rough for ligamentous and muscular attachments.

Posteriorly, by flat facets articulate with the Tarsals.

Laterally, where adjacent, articulate with one another.

Shafts

Narrowest distally, convex above, concave below.

Heads:—Strongly convex

Superiorly, rough for ligamentous attachments.

Inferiorly, grooved for flexor tendons.

Anteriorly, articulate with the phalanges.

Laterally, by tubercles and grooves attach the Lat. Lig'ts. of the Metatarso-Phalangeal Joints.

THE DIFFERENT METATARSALS

FIRST METATARSAL; Shortest and Heaviest.

Base

Encircled by an indistinct groove for the Capsular Lig't.

Posteriorly, a kidney-shaped facet articulates with the Int. Cuneiform.

Internally, a low tubercle gives partial insertion to the **Tibialis Anticus M.**

Externally, occasionally we have a facet for articulation with the second Metatarsal. A rough area on the side of a prominence extending inferiorly receives a partial insertion of the **Peroneus Longus M.**

Shaft

Short and Stout.

Head

Large. Inferiorly, a ridge separates two depressions upon which play sesamoid bones.

SECOND METATARSAL; Longest.

Base

Inferiorly, gives partial origin to the **Adductor Hallucis M.** and partial insertion to the **Tibialis Posticus M.**

Posteriorly, by a concave facet meets the Middle Cuneiform.

Internally, a small facet articulates with the Int. Cuneiform, and an inconstant one with the first Metatarsal.

Externally, shows two facets, an upper and lower, separated by a groove. Anteriorly these articulate with the third Metatarsal; posteriorly with the Ext. Cuneiform.

The **Shaft** and **Head** are characteristic.

THIRD METATARSAL

Base

Inferiorly, gives partial origin to the **Adductor Hallucis M.** and partial insertion to the **Tibialis Posticus M.**

Posteriorly, by a flat facet articulates with the Ext. Cuneiform.

Internally, has two facets articulating with the second Metatarsal.

Externally, a single facet articulates with the fourth Metatarsal.

The **Shaft** and **Head** are characteristic.

FOURTH METATARSAL

Base

Inferiorly, gives partial origin to the **Adductor Hallucis M.** and partial insertion to the **Tibialis Posticus M.,** whose complete insertion therefore includes the three middle Metatarsals.

Posteriorly, a quadrilateral facet articulates with the Cuboid.

Internally, a ridge divides two facets for articulation with the third Metatarsal and Ext. Cuneiform.

Externally, a single facet articulates with the fifth Metatarsal.

The **Shaft** and **Head** are characteristic.

FIFTH METATARSAL

Base

Superiorly, gives insertion to the **Peroneus Tertius M.**

Posteriorly, near the inner side has a facet for articulation with the Cuboid.

Internally, a facet articulates with the fourth Metatarsal.

Externally, is found the **Tuberosity** which distinguishes this bone. It gives insertion to the **Peroneus Brevis,** partly to the **Abductor Minimi Digiti** and when present to the Abductor Ossis Metatarsi Quinti M.

The **Shaft** is characteristic.

Head

Inferiorly, receives a slight insertion of the **Flexor Brevis Minimi Digiti M.**

ORIGIN OF THE INTEROSSEOUS MUSCLES

Dorsal Interossei; Four in number

Origins:—In the four Metatarsal interspaces by a head from the Lat. surface of each adjacent bone; e. g., the first arises from the outer side of the first and inner side of the second Metatarsals.

Plantar Interossei; Four in number.

The first and largest, often called a second head of the Flexor Brevis Hallucis M. arises from the Inf. surface of the Int. and Middle Cuneiforms. The other three arise from the inner sides of the shafts of the third, fourth and fifth Metatarsals.

THE PHALANGES

Long bones, fourteen in all, two for the great toe, and three for each other. The description of the phalanges of the hand entirely fits these. The student will again note that the second phalanx of the great toe is structurally a third and is considered as such.

Muscular Attachments to the First Phalanges

Extrinsic Muscles

Includes all arising above the Tarsus.

Great Toe

Partial insertion Extensor Longus Hallucis.

Intrinsic Muscles

Includes all arising on, or below the Tarsus. Except the Flexor Brevis Digitorum, all intrinsic muscles insert upon the First Phalanges.

Great Toe

Insertion Abductor Hallucis.
" Flexor Brevis Hallucis.
" Adductor Hallucis.
" Innermost slip Extensor Brevis Digitorum.
" on the Fibular side, First Plantar Interosseous.

Second Toe

Tibial Side:—Insertion First Dorsal Interosseous.
Fibular Side:— " Second " "

Third Toe

Tibial Side:—Insertion Second Plantar Interosseous.
Fibular Side: " Third Dorsal Interosseous.

Fourth Toe

Tibial Side:—Insertion Third Plantar Interosseous.
Fibular Side:— " Fourth Dorsal Interosseous.

Fifth Toe

Partial insertion Abductor Minimi Digiti.
Partial insertion Flexor Brevis Minimi Digiti.
Tibial Side:—Insertion Fourth Plantar Interosseous.

The following rules apply to the Interossei of the foot.

Dorsal Interossei

Arise as in the hand, and insert on the Lat. borders and bases of the First Phalanges, choosing the side nearest the mid-line of the **Second Toe.**

Plantar Interossei

Insert on the Lat. borders and bases of the First Phalanges in those places not occupied by the Dorsal Interossei; namely, the Fibular side of the first and Tibial side of the second, third and fourth. These three arise from the same side of the Metatarsal of the same toe. The first comes from the Int. and Middle Cuneiforms.

Muscular Attachments to the Second Phalanges

Extrinsic Muscles

Insertion on bases of outer four toes of the middle slips of the tendons of the Extensor Longus Digitorum. With those of the second, third, and fourth toes fuse the corresponding slips of the Extensor Brevis Digitorum.

Intrinsic Muscles

Insertion of the tendons of the Flexor Brevis Digitorum on the bases of the outer four toes.

Muscular Attachments to the Third (Distal) Row

Extrinsic Muscles

Great Toe

Insertion, dorsally, Extensor Longus Hallucis.
" on the plantar surface, Flexor Longus Hallucis.

Other Toes

Insertion Lat. expansions tendons Extensor Longus Digitorum.
" plantar surface, Flexor Longus Digitorum. With this muscle insert the Lumbricales and the Flexor Accessorius.

THE ANKLE-JOINT

The Inf. surface of the lower extremity of the Tibia articulates with the Trochlear facet of the Astragalus and the two Malleoli with corresponding surfaces upon its sides.

Ligaments

Capsular:—Above, except in rising slightly on the Ant. surface of the Tibia, it attaches around the margin of the continuous articular surface afforded by the two leg bones. Below the same is true. Here again the Ant. portion passes forward, fastening to the Neck of the Astragalus.

Four strengthening bands are observed.

1. **Anterior**:—Slight thickening.
2. **Posterior**:—Weak.
3. **Internal Lateral, or Deltoid**:—Very strong. Fastened above to the tip and Post. border of the Int. Malleolus, and below to the Astragalus under the Int. articular surface, and to the Sustentaculum Tali.
4. **External Lateral**:—Also very strong. Consists of three bands.
    a. **Anterior**:—extending from the Ant. margin of the Ext. Malleolus to a depression in front of the Ext. articular surface on the Astragalus.
    b. **Middle**:—passing from the tip and Ant. margin of the Ext. Malleolus to a tubercle on the Ext. surface of the Calcaneum.
    c. **Posterior**:—attaching to the Digital Fossa of the Fibula and to a depression behind the Ext. articular surface on the Astragalus.

Type of Joint:—Ginglymus.

ARTICULATIONS OF THE FOOT

In intrinsic movements of the foot four Tarsal joints are important.

1. **Posterior Calcaneo-Astragaloid.**
2. **Anterior Calcaneo-Scapho-Astragaloid.**
3. **Calcaneo-Cuboid.**
4. **Scapho-Cubo-Cuneiform.**

Other joints simply add to the pliability of the foot, and are not worthy of description.

Post. Calcaneo-Astragaloid Joint.

The facet upon the Inf. surface of the Astragalus articulates with the corresponding Post. facet upon the Calcaneum.

Ligaments

1. **Interosseous:**—Extends between the two bones filling the Sinus Pedis. It separates the two joints between these bones, and forms their strongest tie.

2. **Ext. Lat. Astragalo-Calcaneal:**—Lies superficially between the outer surfaces of the two bones.

3. **Capsular:**—Passes around the articular surfaces and has a strengthening band, the Post. Astragalo-Calcaneal Lig't.

The two Lat. Lig'ts. of the ankle joint are effective in keeping the Astragalus in place.

Type of Joint:—Arthrodial.

Ant. Calcaneo-Scapho-Astragaloid Joint

Here we have a ball and socket joint of rather complicated make up. The "ball" is the head of the Astragalus. The "socket" is made by:

1. The Ant. facet of the Calcaneum.
2. The Post. facet of the Scaphoid.
3. The Ext. Calcaneo-Scaphoid Lig't.
4. The Inf. Calcaneo-Scaphoid or Spring Lig't.

Ligaments

1. **Sup. Astragalo-Scaphoid:—** Passes between the inner and dorsal aspects of the two bones.
2. **Interosseous Calcaneo-Cubo-Scaphoid:—** Joins the front of the Calcaneum and Ext. margin of the Scaphoid and sends a weak slip to the Cuboid.
3. **Interosseous Astragalo-Calcaneal:—** Common with preceding joint.
4. **Superior Calcaneo-Scaphoid:—** Is the inner part of the Interosseous Calcaneo-Cubo-Scaphoid.
5. **Inferior Calcaneo-Scaphoid, or Spring Lig't.:—** Extends between the Ant. part of the Sustentaculum Tali and the Tuberosity of the Scaphoid. It has a cartilaginous coating where it glides over the Astragalus.

Fusion of these ligaments, with the addition of the Deltoid forms a complete capsule for the joint.

Type of Joint:— Enarthrodial.

Calcaneo-Cuboid Joint

The facet upon the Ant. surface of the Calcaneum articulates with a corresponding facet upon the Post. surface of the Cuboid.

Ligaments

1. **Capsular:**—Attaches around the margins of the articular surfaces.
    - a. The Calcaneo-Cubo-Scaphoid, forms its inner side.
    - b. The Dorsal Calcaneo-Cuboid, is a slight Sup. thickening.
2. **Plantar Calcaneo-Cuboid:**—Two in number.
    - a. Long Plantar:—Extends between the Inf. surfaces of the Calcaneum and the ridge of the Cuboid. Some fibres pass on to the bases of the third, fourth, and fifth Metatarsals.
    - b. Short Plantar:—Passes from the tubercle of the Calcaneum to the Cuboid behind the ridge.

Type of Joint:—Arthrodial.

Scapho-Cubo-Cuneiform Joint

Occasionally a facet upon the Ext. surface of the Scaphoid meets a similar one on the Int. surface of the Cuboid. The Ant. surface of the Scaphoid, by three facets, articulates with the Post. surfaces of the Cuneiforms.

Ligaments

Between the Scaphoid and Cuboid.

Dorsal, Plantar and Interosseous.

Between the Scaphoid and Cuneiforms.

1. Three Dorsal Bands.
2. Three Plantar Bands, formed largely by fibres from the tendons of the Tibialis Posticus.

Type of Joint:—Arthrodial.

THE TARSO-METATARSAL JOINTS

The Ant. surfaces of the three Cuneiforms and Cuboid articulate with the Post. surfaces of the bases of the Metatarsals, the Ant. Lat. facets upon the Int. and Ext. Cuneiform with corresponding facets on the second Metatarsal. The first joint, between Int. Cuneiform and First Metatarsal is distinct, having a separate capsule and synovial sack. Its ligaments except for this are the same as for the rest of the joints.

Ligaments

Dorsal:—Eight weak bands are described.

Interosseous:—Three in number.

Plantar:—Irregular bands of inconstant number.

Type of Joints:—Arthrodial.

The **Intermetatarsal, Metatarso-Phalangeal,** and **Interphalangeal Joints** resemble the corresponding articulations in the hand. q. v. p. 61 and 62.

The student should note that in the foot the Distal or Transverse Metatarsal Lig't. joins the Glenoid Cartilages upon the extremities of all the Metatarsals instead of the outer four, as in the hand.

ANNULAR LIGAMENTS OF THE ANKLE

These structures are merely strengthening bands of the Crural Fascia, which invests the leg. During the action of the leg muscles they keep the tendons of the leg in place.

1. **Ant. Annular Lig't.** has two parts:—
   a. Joins lower ends of Tibia and Fibula.
   b. Below this attaches to the Ext. surface of the Calcaneum. It passes inward and divides into two bands, one of which attaches to the Int. Malleolus, and the other proceeds downward to join the Plantar Fascia.

2. **Int. Annular Lig't:**—Passes down from the Int. Malleolus to the Calcaneum, bridging over a groove for tendons.

3. **Ext. or Lat. Annular Ligt.:**—Two slips:
   a. Upper; Ext. Malleolus to Calcaneum.
   b. Lower; Extends across outer surfaces Calcaneum.

General Considerations

The vaulted character of the foot is readily apparent. Longitudinally, the arch upon the inner side of the foot is seen to be higher than that on the outer. It is sometimes called the **Superior Arch,** and consists of the Astragalus as keystone, and two pillars; the Anterior is made by the Scaphoid, three Cuneiforms and three Inner Metatarsals; the Posterior by the Calcaneum. The Cuboid and two outer Metatarsals form a second anterior column.

The integrity of this arch is maintained principally by:

1. The Inf. Calcaneo-Scaphoid Lig't.
2. The Long and Short Plantar Lig'ts.
3. The tendon of the Tibialis Posticus.
4. The Plantar Fascia.

Transversely the greatest arch lies through the heads of the Metatarsals. In addition to the Interosseous Lig'ts., the tendon of the Peroneus Longus is important in maintaining it.

In life the foot is in contact with the ground by means of the tubercles of the Calcaneum, the tuberosity of the fifth, and the head of the first Metatarsal.

SECTION III

THE AXIAL SKELETON

SPINAL COLUMN

The spinal column forms a flexible central axis for the body. It is composed of many segments separated by fibro-cartilaginous disks. Above, it supports the head, and below terminates by being firmly fixed between the pelvic bones.

Thirty-three, or thirty-four vertebrae compose the spine. From the head down they are divided as follows:

7	Cervical.
12	Dorsal or Thoracic, bearing the ribs.
5	Lumbar.
—	
24	Free bones above the Pelvis, the Presacral Group.
5	Joined to form Sacrum.
4 or 5	Coccyx.
—	
33 or 34	in all.

The vertebral column presents four normal curves, cervical, thoracic, lumbar, and pelvic. The cervical and lumbar are convex forward, the thoracic and pelvic are convex backward.

Many muscles find origin and insertion throughout the spine. See table on p. 130.

Typical vertebrae regardless of location have the following common characteristics:

1. **Body or Centrum**:—The largest part of the vertebra, roughened above and below for the attachment of the **Intervertebral Disks.** The Ant. Surface is convex, and attaches the **Ant. Common Lig't.** The Post. surface is flattened forming the Ant. wall of the Spinal foramen and attaching the **Post. Common Lig't.** These two Lig'ts. extend from the Axis to the Sacrum.

2. **Pedicles**:—Extend backward from each side of the Post. surface of the body, helping to form the Lat. boundaries of the Spinal foramen, and continuing into the Laminae. The lower borders form the roofs of the deep **intervertebral notches,** made into foramina by the pedicles of the vertebra below, and transmitting the Spinal nerves.

3. **Laminae**:—Plates of bone which unite behind to form the vertebral arch and thus complete the spinal foramen. The **Ligamenta Subflava** join the consecutive Laminae.

4. **Spinous Process**:—Projects back, or down, at the point of union of the laminae. The **Supraspinous** and **Interspinous Lig'ts.** connect them.

5. **Transverse Processes**:—Lat. projections springing from the junction of pedicles and laminae.

6. **Articular Processes**:—Four in number, in line with the junction of pedicles and laminae. The two superior extend upward and the inferior downward.

TYPICAL CERVICAL VERTEBRAE

Third, Fourth, Fifth, and Sixth

Body:—Small, elliptical with long axis transversely.
Superiorly, concave with Lat. projections.
Inferiorly, correspondingly convex with Lat. concavities. The Ant. Inf. border extends downward overlapping the vertebra below.

Pedicles:—Short. The Sup. intervertebral notches are smaller, and deeper than the inferior.

Laminae:—Smooth and plate-like.

Spinous Processes:—Short, bifid, and projecting slightly downward.

Transverse Processes:—Two limbs; the posterior (true transverse process) springs from the junction of pedicles and laminae and terminates in the Post. Transverse tubercle; the anterior from the side of the body and terminates in the Ant. Transverse tubercle. These are joined externally by the **Costal process** (rudimentary rib) thereby forming the **Vertebral,** or **Costo-transverse Foramen** which transmits the Vertebral Vessels. The Ant. Transverse Tubercle of the sixth is known as the **Carotid Tubercle** from its surgical relations to the Int. Carotid A.

Articular Processes:—Superior face up, and slightly back; inferior down, and slightly forward.

ATYPICAL CERVICAL VERTEBRAE

ATLAS

The first vertebra, from its function of supporting the head, is known as the Atlas. It shows modified vertebral characteristics, but is minus a body. (The

Odontoid Process of the Axis represents this apparent loss).

The **Atlas** presents for examination:

1. **Anterior Arch** (one-fifth)
2. **Two Lateral Masses** (each one-fifth)
3. **Posterior Arch** (two-fifths)

1. **Ant. Arch:**—The Ant. Tubercle lies in the mid-line in front. It attaches muscles and three ligaments, the **Ant. Occipito-Atlantal,** the **Ant. Atlanto-Axial,** and the **Accessory Occipito-Atlantal.** Posteriorly there is a round facet for articulation with the Odontoid Process.

2. **Lat. Masses:**—Superiorly, they present long concave facets for articulation with the condyles of the Occipital; inferiorly, flat circular facets for articulation with the Axis. Internally each has a rough tubercle, between which stretches the **Transverse Lig't.,** holding the Odontoid Process in position. External to these are the **Vertebral foramina.** The **Vertebral A.** leaving these formina pass back, and in behind the Lat. Masses to enter the Foramen Magnum. They often groove the bone. The same groove transmits the **Suboccipital N.**

3. **Post. Arch:**—Superiorly, attaches the **Post. Occipito-Atlantal Lig't.,** inferiorly the **Post. Atlanto-Axial Lig't.** The Inf. intervertebral notch lies **behind** the articular process, not in front, as in the succeeding vertebrae. A tubercle represents the Spinous Process.

SUMMARY

Ant. Arch:—Attaches Ant. Occipito-Atlantal Lig't.
" Ant. Atlanto-Axial Lig't.
" Accessory Occipito-Atlantal Lig't.
Facet for Odontoid.

Lat. Masses:—Attach Transverse Lig't.
Groove for Vertebral A., and Suboccipital N.
Facets above and below.
Post. Arch:—Attaches Post. Occipito-Atlantal Lig't.
" Post. Atlanto-Axial Lig't.
Intervertebral Notches behind facets.

AXIS

Body:—Long. Superiorly, it is prolonged into the **Odontoid Process**, a tooth-like projection, articulating anteriorly with the Atlas and posteriorly confined by the Transverse Lig't. The **Middle Odontoid Lig't** extends up from the tip, and from each side passes out a **Lat. Odontoid** or **Check Lig't.** Below the process the body anteriorly attaches the beginning of the **Ant. Common Lig't.**, posteriorly the Occipito-Axial continuing into the **Post. Common Lig't.**

External to the Odontoid Process and superiorly two round facets articulate with corresponding ones upon the Axis.

Spinous Process:—Large and bifid.

Transverse Processes:—Small.
Transverse Foramina are directed outward.

Articular Processes:—Inferior, small and behind the notch as in typical vertebra.

SUMMARY

Superiorly:—Odontoid attaching Mid. and Check Lig'ts. and presenting two facets.

Inferiorly:—Notches behind articular processes.

Anteriorly:—Attachment Ant. Common Lig't.

Posteriorly:—Attachment Post. Common Lig't.

VERTEBRA PROMINENS

The seventh Cervical vertebra receives this name from its long unbranched Spinous Process which extends horizontally back and attaches the **Ligamentum Nuchae.** The Vertebral Foramina are small, or lacking.

TYPICAL THORACIC OR DORSAL VERTEBRAE SECOND TO EIGHTH INCLUSIVE

Body:—Heart-shaped. Laterally, placed in line with the origin of the Pedicles, we find two half facets, a superior and inferior, for articulation with the heads of the Ribs.

Pedicles:—Plate-like. Notched below only, forming the Intervertebral Foramina.

Laminae:—Broad, enclosing a small circular Spinal Foramen.

Spinous Process:—Long, and overlapping.

Transverse Processes:—Thick and long. A concave facet near the tip articulates with a similar one upon the tuberosity of the corresponding rib. These processes attach the **Sup., Mid.** and **Post. Bands** of the **Costo-Transverse (Stellate) Lig't.**

Articular Processes:—Superior face backward; inferior forward.

ATYPICAL THORACIC VERTEBRAE

FIRST

The Sup. surface of the body corresponds to that of the Inf. surface of the Seventh Cervical resting upon it. Laterally there is a complete facet above for the head of the first rib, and a demifacet below.

NINTH

Demifacet above; no facet below.

TENTH

One complete facet above.

ELEVENTH

Body large, with one complete facet. The Transverse Processes are short and bear no facets.

TWELFTH

Body of Lumbar type, and has one complete facet. Spinous Process, short and horizontal.

Transverse Processes have three tubercles and no facets. The Inf. Articular Processes face outward.

TYPICAL LUMBAR VERTEBRAE

THE FIRST FOUR

Body:—Kidney-shaped, and larger than in any other vertebrae.

Pedicles:—Short, and thick. The larger intervertebral notch is below.

Laminae:—Heavy.

Spinous Process:—Quadrilateral, and projects horizontally.

Transverse Processes:—Light.

Articular Processes:—Superior face in; inferior face out.

Mammillary Processes:—Small rounded tubercles directed backward upon the Sup. Articular Processes.

Accessory Processes:—Small tubercles at the roots of the Transverse Processes. They point downward and represent the true Transverse Processes, the so-called ones being really rudimentary costal elements.

ATYPICAL LUMBAR VERTEBRA

FIFTH

Body:—Largest. Thicker in front than behind.

Spinous Process:—Small.

TABULAR SUMMARY OF PRESACRAL TYPICAL VERTEBRA

	CERVICAL.	THORACIC.	LUMBAR.
Body	Elliptical and small, with upward projections laterally, and downward anteriorly. No facets.	Heart-shaped. Demifacets.	Large, and kidney-shaped. No facets.
Spinal Canal	Triangular, and largest proportionally.	Round and smallest.	Sharply triangular.
Pedicles	Marked notches above and below.	Notches entirely below.	Sup. notches slight; Inf. large.
Laminae	Long and light.	Short, deep plates.	Heavy. Concave posteriorly.
Spinous Processes	Horizontal and bifid.	Long and overlap.	Short and flattened transversely.
Transverse Processes	Two tubercles, and Vertebral Foramen.	Heavv. Facet anteriorly for rib.	Light. Mammillary and Accessory Processes.
Articular Processes	Flat. Superior face up; inferior face down.	Flat. Superior face back; inferior face front.	Concave. Superior face in; inferior face out.

TABLE OF MUSCLES OF THE BACK

GROUP A.—SUPERFICIAL MUSCLES

Spinal Origin	1. Latissimus Dorsi. Spinous Processes 6th to 12th Thoracics.
" "	2. Levator Anguli-Scapulae. Transverse Processes upper four Cervicals.
" "	3. Rhomboideus Major. Spinous Processes 1st to 4th Thoracics.
" "	4. Rhomboideus Minor. Spinous Process 7th cervical.
" "	5. Serratus Posticus Superior. Spinous Processes 7th cervical and upper two thoracics.
" "	6. Serratus Posticus Inferior. 10th to 12th thoracics and first two lumbars.

GROUP B.—DEEP LONG MUSCLES

a. Splenius.

b. Extensor Dorsi Communis.

1. Spino-Transversalis. Common mass known as Erector Spinae. Extends from spinous process outward.

Outer Series {
Ilio-Costalis Lumborum.
" " Dorsi or Accessorius.
" " Cervicis or Cervicalis Ascendens.

Middle Series
- Longissimus Dorsi.
- " Cervicis or Transversalis Cervicis.
- " Capitis or Trachelo-Mastoid.

Inner Series
- Spinalis Dorsi.
- " Cervicis.
- " Capitis.

2. Transverso-Spinalis. Extends from Spinous Processes inward.

Long Series
- Semispinalis Dorsi.
- " Cervicis.
- " Capitis.

Medium Series
- Multifidus Spinae.

Short Series
- Rotatores Spinae.

GROUP C.—DEEP SHORT MUSCLES

1. Interspinales.
2. Intertransversales.
3. Levatores Costorum.
4. Suboccipitals.
    - a. Rectus Capitis Posticus Major.
    - b. " " " Minor.
    - c. Superior Oblique.
    - d. Inferior "
    - e. Rectus Capitis Lateralis.

SACRUM

Composed of five fused vertebrae. It presents for examination:

Base
Apex
Anterior
Posterior
Two Lateral } **Surfaces.**

Base or Sup. surface:—Shows a central oval area articulating with the fifth Lumbar Vertebra, and possessing a sharp margin anteriorly, the **Promontory** of the Sacrum. Posteriorly, it is bounded by the triangular Spinal Canal. Laterally, the base spreads out into the **Alae,** homologous with the transverse processes. These, when the bones are in position, continue the Iliac Fossa and with it give origin to the **Iliacus M.** They support the **Lumbo-Sacral Cord.**

Articular Processes, facing back, spring from marked Pedicles. Between them and the body occurs the last pair of intervertebral notches, forming the lower halves of the last Intervertebral Foramina.

Apex:—Presents an articular surface for the Coccyx.

Surfaces

Anterior:—Concave, and triangular. Four transverse ridges mark the lines of Vertebral fusion. Four pairs of foramina, **Ant. Sacral,** transmit the Ant. divisions of the first four Sacral N. External to, and between these we have a partial origin of the **Pyriformis M.** Below the fourth foramen is a slight insertion of the **Coccygeus M**; and the entire edge attaches the thin **Ant. Sacro-Iliac Lig'ts.**

Posterior:—Centrally, a series of Spinous Processes appears, the first always well marked. Inferiorly, we have the lower opening of the spinal canal, the **Hiatus Sacralis.** Passing outward the fused laminae form the broad **Sacral Groove,** giving partial origin to the **Erector Spinae M.** The lower two pairs do not join, but form divergent ridges ending in projections, the **Sacral Cornua,** which articulate with the Cornua of the Coccyx, thus completing the fifth sacral foramina for the Post. divisions of the fifth nerve. External to the Sacral Groove four more foramina, **Post Sacral,** transmit the Post. divisions of the upper four nerves. External to these a series of dull tubercles represents the Transverse Processes. The **Gluteus Maximus M.** has a slight origin on the outer margin of the bone below the third foramen.

Lateral Surfaces:—These are limited in front by a sharp border, and extend behind to the rudimentary Transverse Processes. The broad upper part has two divisions.

1. **Auricular** surface, articulating with the similar Iliac surface.

2. An area of rough depressions attaching the **Post. Sacro-Iliac Lig'ts.** This lower portion narrows into a sharp line. Anteriorly, it attaches the **Lesser Sacro-Sciatic Lig't**; posteriorly the **Greater Sacro-Sciatic Lig't.** Near the Apex a broad notch permits the egress of the Ant. division of the fifth Sacral N.

SUMMARY

Superiorly:—Articular surface, Promontory, Notches, Articular Processes and Alae. Origin Iliacus, Lumbo-Sacral Cord supported.

Inferiorly:—Articulates with Coccyx.

Anteriorly:—Ant. Sacral Foramina.
Origin Pyriformis. Insertion Coccygeus.
Attaches Ant. Sacro-Iliac Lig'ts.

Posteriorly:—Hiatus Sacralis.
Sacral Groove. Origin Erector Spinae.
Sacral Cornua.
Post. Sacral Foramina.
Origin Gluteus Maximus.

Laterally:—Auricular surface.
Attachment Post. Sacro-Iliac Lig'ts.
" Lesser Sacro-Sciatic Lig'ts.
" Greater " " "
Notch for Fifth N.

COCCYX

A triangular structure composed of four or five rudimentary vertebrae. Presents:

Base	**Borders**	**Surfaces**
Apex	Two Lateral	Anterior
		Posterior

Base:—Articulates with Sacral Apex.

Apex:—Gives origin to **Sphincter Ani Externus M.**

Lateral Borders:—Thin. Attach **Greater** and **Lesser Sacro-Sciatic Lig'ts.**

Surfaces

Anterior:—Concave, and grooved at junction of segments. It gives insertion to the **Coccygeus** and **Levator Ani M.**

Posterior:—Superiorly, two projections, the **Coccygeal Cornua,** articulate with the Sacral Cornua. The upper Transverse Processes extend horizontally below these. They are grooved above, and with the notches on the lower Lat. borders of the Sacrum transmit the Ant. division of the 5th N.

Anteriorly, transverse grooves represent the lines of junction, and dull prominences the Transverse Processes. The Sacral origin of the **Gluteus Maximus M.** usually continues down upon this surface of the Coccyx.

SUMMARY

Superiorly:—Sacral articulations.

Inferiorly:—Origin Ext. Sphincter.

Anteriorly:—Insertion Coccygeus and Levator Ani.

Posteriorly:—Coccygeal Cornua. Origin Gluteus Maximus.

Laterally:—Attachment Greater and Lesser Sacro-Sciatic Lig'ts.

SACRAL AND SPINAL ARTICULATIONS

SACRO-ILIAC

The auricular surface of the Sacrum articulates with a similar surface upon the Ilium.

Ligaments

1. **Anterior Sacro-Iliac**:—Unimportant bands which connect the adjacent Ant. surfaces.
2. **Posterior Sacro-Iliac**:—Fills the depression behind the articular surfaces, extending between the Post. rough areas.
3. **Oblique Sacro-Iliac**:—A band, part of the Posterior, passing between the Post. Sup. Iliac Spine and the third transverse tubercle of the Sacrum.
4. **Ilio-Lumbar**:—Joins the Transverse Process of the fifth lumbar vertebra, and the Iliac Crest posteriorly.
5. **Lumbo-Sacral**:—Attaches above to the last lumbar Transverse Process, and below blends with the Ant. Sacro-Iliac.

Type of Joint:—Arthrodial.

VERTEBRAL ARTICULATIONS

The vertebrae are connected by many ligaments whose arrangement follows that of their component parts.

Ligaments of the Bodies

1. **Intervertebral Disks**:—Fibro-cartilaginous structures uniting the adjacent body surfaces.

2. **Ant. Common**:—Attaches above to the body of the Axis, from which as a series of short bands adherent to the intervertebral disks and bodies it passes to the Sacrum.

3. **Post. Common**:—Lies inside the Spinal Canal, extending from the back of the Axis to the Sacrum.

Laminae

1. **Ligamenta Subflava**:—Elastic bands joining the laminae from the Axis to the Sacrum.

Spinous Processes

1. **Interspinous**:—Connect the spines from root to tip.

2. **Supraspinous**:—Attaching above to the apex of the seventh cervical, it is continuous to first Sacral spine.

Ligamentum Nuchae:—In the neck the Interspinous and Supraspinous Lig'ts. become a heavy elastic sheet, extending between the Ext. Occipital Protuberance and the seventh cervical spine. This is called the Ligamentum Nuchae.

Transverse Processes

1. **Intertransverse**:—Weak fibres between the processes.

Articular Processes

1. **Capsular**:—Surround the articulations, fusing with and being completed internally by the Ligamenta Subflava.

The joints between the vertebral bodies are Syndesmoses; between the articular processes, Arthrodia.

OCCIPITO-ATLANTAL ARTICULATION

The condylar facets upon the Occipital articulate with corresponding facets upon the Atlas.

Ligaments (Two Sets)

1. Attaching Occipital and Atlas.

(a) **Ant. Occipito-Atlantal**:—Between Ant. margin Foramen Magnum and tubercle on Ant. arch Atlas.

(b) **Post. Occipito-Atlantal**:—Between Post. margin Foramen Magnum and upper border Post. arch Atlas.

(c) **Accessory Occipito-Atlantal**:—Between Basilar Process Occipital and Ant. tubercle Atlas, continuing to Axis.

(d) **Capsulars**:—Surround the condylar articulations.

2. Attaching Occipital and Axis.

(a) **Lateral Odontoid or Check**:—Pass from each side of the tip of the Odontoid to the inner sides of the Occipital Condyles. They "check" extreme rotation of the head.

(b) **Middle Odontoid**:—Between tip of Odontoid and Basilar Process.

(c) **Occipito-Axial**:—Between Basilar Process and body of Axis in the Spinal canal. It is continuous with the Post Common Lig't.

Type of Joint:—Condylarthrosis.

ATLANTO-AXIAL ARTICULATION

The Ant. arch of the Atlas articulates with the Odontoid Process of the Axis, confined by the Transverse Lig't. and the facets on the Inf. surface of the Atlas articulate with the corresponding ones upon the Sup. surface of the Axis.

Ligaments

1. **Ant. Atlanto-Axial**:—A continuation of the Ant. Occipito-Atlantal, between Ant. tubercle of Atlas and base of Odontoid.

2. **Post. Atlanto-Axial**:—Continues Post. Occipito-Atlantal, connecting Post. arch of Atlas and laminae of Axis, supplying the place of Ligamenta Subflava.

3. **Transverse**:—Passes between tubercles on inner sides of Lat. masses of Atlas, embracing the Odontoid.

4. **Capsulars**:—Attach around articular processes.

Type of Joint:—Odontoid with Atlas (pivotal), trochoides.
Articular Processes, Arthrodial.

Cruciform Lig't.—This is a composite structure. The Sup. band passes up from the Transverse Lig't. to the cerebral side of the Basilar Process of the Occipital. The Inf. band goes down to body of Axis. A cross is thus formed which is attached to all three bones.

RIBS

Classified according to their attachment:—

7 Vertebro-Sternal or True Ribs.
3 Vertebro-Chondral } False ribs.
2 Vertebral, or Floating }

All articulate posteriorly with the bodies and transverse processes of the Vertebrae. The true ribs by means of individual cartilages join the Sternum. The Vertebro-chondral join by means of a common cartilage fused to that of the last true rib (seventh). The Vertebral have no Ant. articulation.

The first, second, tenth, eleventh, and twelfth ribs are atypical, and need a special description.

TYPICAL RIBS

THIRD TO NINTH INCLUSIVE.

Present for examination:

Head.
Neck.
Tuberosity.
Shaft.
Sternal Extremity.

Head

The enlarged Post. extremity. It shows two poorly marked oblong facets, the inferior articulating with the Vertebra of the same number, the superior with the Vertebra above. A ridge, attaching the **Intervertebral Lig't.** separates them.

Neck

Extends from the Head to the Tuberosity. Superiorly, a sharp crest attaches the **Sup.** or **Ant. Costo-Transverse Lig't.**, and posteriorly, a rounded surface attaches the **Mid. Costo-Transverse Lig't.** The **Capsule** of the Costo-Central Joint, strengthened in front by the Ant. Costo-Vertebral Lig't., is attached all around the Neck.

Tuberosity

An eminence posteriorly about an inch from the Head, near the lower border of the rib. Internally it shows a small facet for articulation with a similar one upon the transverse process of the lower of the two vertebrae which the Head joins. Outside this a roughness attaches the **Post.** or **Ext. Costo-Transverse Lig't.**

Shaft

Two borders and two surfaces.

Sup. Border:—Shows two indefinite lips, an internal and external, attaching respectively the **Int.** and **Ext. Intercostal M.**

Inf. Border:—Has two well marked lips separated by a groove. The external is sharp and prominent. It disappears anteriorly and is the real Inf. border. The **Ext. Intercostal M.** is attached. The internal is dull. It attaches the **Int. Intercostal M.**

The **Subcostal Groove** gives passage to the **Intercostal Vessels** and **N.**

Int. Surface:—Smooth and concave.

Ext. Surface:—Convex. The **Angle** marks a sharp bend about an inch and a half external to the Tuberosity. It is marked externally by an oblique line, and attaches portions of the **Erector Spinae M.** [illegible] major & minor

Sternal Extremity:—Deeply concave for attachment of the cartilage.

To tell a right from a left rib place the bone upon a table so that the head (vertebral extremity) projects upward.

SUMMARY

Head:—Two facets, and attachment Intervertebral Lig't.

Neck:—Attachment Sup. Costo-Transverse Lig't.
" Middle Costo-Transverse Lig't.
" Capsule Costo-Central Joint.

Tuberosity:—Facet and attachment Ext. Costo-Transverse Lig't.

Shaft

Superiorly:—Intercostal M.

Inferiorly:—Intercostal M., Vessels and N.

Externally:—Angle. Erector Spinae M.

Sternal Extremity:—Cartilage.

ATYPICAL RIBS

FIRST

Short and flat with Sup. and Inf. surfaces instead of internal and external.

Head:—Small. A single facet articulates with first thoracic vertebra.

Neck:—Short.

Tuberosity:—Large, and facing backward.

Shaft

Sup. Surface:—Near the Tuberosity a depression gives insertion to the **Scalenus Medius M.** The **Scalenus Anticus M.** inserts upon the **Scalene Tubercle,** a small prominence on the Int. border at the termination of a slight ridge which separates two shallow grooves, the anterior for the **Subclavian V.,** the posterior for the **Subclavian A.** These grooves are often only to be recognized by feeling.

Inf. Surface:—Flat. There is no Subcostal Groove.

SUMMARY

Head:—One facet.
Shaft Superiorly:—Insertion Scalenus Medius M.
Groove Subclavian A.
Scalene Tubercle. Insertion Scalenus Anticus M.
Groove Subclavian V.

SECOND

Longer than the first, with the surfaces beginning to face as in the typical ribs.

Head, Neck, and **Tuberosity** are characteristic.

Sup. Surface:—Angle slight, giving partial origin to the **Serratus Posticus Superior M.** The **Scalenus Posticus M.** inserts upon a rough line just beyond this. Near the middle and along the Post. border a prominence attaches the second and third digitations of origin of the **Serratus Magnus M.**

Inf. Surface:—Concave. The groove is slight. Attachments, etc., are characteristic.

TENTH

Shows a single facet on the head. Facet and Tuberosity may be lacking.

ELEVENTH

One facet on head. Tuberosity very small, and without facet.

TWELFTH

One facet on head. Tuberosity, Angle, and Subcostal Groove are lacking.

MUSCULAR ATTACHMENTS TO RIBS

MUSCLE.	ORIGIN.	INSERTION.
Ext. Intercostals.	11 in No. Pass from Inf. border of one rib	to Sup. border of the next.
Int. Intercostals.	11 in No. Underlie the Externals attaching	similarly.
Scalenus Anticus.	Trans. Processes 3 to 6 Cervical Vert.	Scalene Tubercle.
" Medius.	Trans. Processes 2 to 7 Cervical Vert.	Sup. Surface 1st rib.
" Posticus.	Trans. Processes 4 to 7 Cervical Vert.	Sup. Surface 2d rib.
Pectoralis Minor.	Ext. Surface 3 to 5 ribs.	Coracoid Process.
Serratus Magnus.	Ext. Surface 1 to 8 or 9 ribs by 9 or 10 digitations.	Scapula.
Ext. Oblique.	Ext. Surface 5 to 12 ribs by 8 digitations.	Ilium and Aponeurosis.
Quadratus Lumborum.	Trans. Processes 2 to 5 Lumbar Vertebrae and Ilium.	Inf. border 12th rib.
Diaphragm.	Sternum, Costal Cartilages 7 to 12 and Lumbar Vertebrae 1 to 4.	Central Tendon.
Latissimus Dorsi.	Spinous Processes 7 to 12 Thoracic Vertebrae, Ilium, and Ext. Surface lower 3 or 4 ribs.	Bicipital Groove.
Serratus Posticus Superior.	Spines 7 cervical, and 1st, 2d and 3d Thoracic Vertebrae.	Ext. Surface 2 to 5 ribs.
Serratus Posticus Inferior.	Spines 10 Thoracic to 2d Lumbar Vertebra.	Ext. Surface lower 4 ribs
Rectus Abdominis.	Xiphoid, Cartilages of 5th, 6th and 7th ribs.	Crest of pubis.
Erector Spinae.		
a. Ilio-Costalis.	Crest of the Ilium.	Int. to Angle as far as 4th Cervical.
b. Longissimus Dorsi.	Last 6 thoracic vertebrae.	Lumbar and Thoracic vertebrae and ribs [to the 7th.
Levatores Costorum.	Trans. Proc. 7th Cerv. and first 11 Dorsal Vert.	Next suceeding ribs.
Positions Pg. 130 and 131.		

COSTAL ARTICULATIONS

VERTEBRAL

A. Costo-Central

The Head of the Rib by two facets articulates with the Bodies and Intervertebral Disk of adjacent Vertebrae.

Ligaments

1. **Two Capsulars**:—Attach about the Heads and to the Bodies of the Vertebrae.

2. **Intervertebral**:—Passes from a ridge separating the facets to the Intervertebral Disk.

3. **Ant. Costo-Vertebral** or **Stellate**:—Three flat bands passing from Head:—

a. **Superior,** to body of Vertebra above.
b. **Inferior,** to body of Vertebra below.
c. **Middle,** to Intervertebral Disk.

Type of Joint:—Arthrodial.

This articulation in the 1st, 2nd, 11th, and 12th ribs is not subdivided, and in these cases we do not have distinct fasiculi in this ligament.

B. Costo-Transverse

The facets upon the Tuberosities articulate with corresponding ones upon the Transverse Processes.

Ligaments

1. **Capsular**:—Surrounds joint.

2. **Sup.** or **Ant. Costo-Transverse**:—Joins Sup. border Neck of Rib and Inf. Border Transverse Process immediately above.

3. **Middle Costo-Transverse:**—Joins Post. surface Neck, and Ant. part Transverse Process of same Vertebra.

4. **Post.,** or **Ext. Costo-Transverse:**—Joins Tuberosity and tip of Transverse Process of same Vertebra.

Type of Joint:—Arthrodial.

Sup. Costo-Transverse Lig't. lacking in first and last joints.

Middle Costo-Transverse Lig't. rudimentary in eleventh and twelfth joints.

Articulation lacking for eleventh and twelfth ribs.

STERNUM

Consists of three flat bony plates, the Manubrium, Gladiolus, and Ensiform Cartilage, or Xiphoid Process.

MANUBRIUM

Quadrilateral, possessing four borders, and two surfaces.

Borders

Superior:—Thick and concave. The **Interclavicular** or **Suprasternal Notch** separates two facets articulating with the Sternal Extremities of the Clavicles.

Inferior:—Shows a rough oval surface articulating through a fibro-cartilage with the Gladiolus. This joint forms a prominent landmark of the chest, and is known as **Ludwig's Angle.**

Two Lateral:—Upper corners bear facets for the cartilages of the first ribs; lower corners, demifacets for the cartilages of the second.

Anterior:—Rough. On either side just below the Notch we have the sternal origins of the **Sterno-Cleido-Mastoid M.**, and laterally below these of the **Pectoralis Major M.**

Posterior:—Smooth. Beneath the Clavicular facets the **Sterno-Hyoid M.** takes origin, and below this the **Sterno-Thyroid M.**

SUMMARY

Superiorly:—Notch and clavicular facets.

Inferiorly:—Articulation Gladiolus. Ludwig's Angle.

Anteriorly:—Origin Sterno-Cleido-Mastoid.
" Pectoralis Major.
Posteriorly:—Origin Sterno-Hyoid.
" Sterno-Thyroid.
Laterally:—Facets 1st two ribs.

GLADIOLUS

Long and narrow. Four borders and two surfaces.

Borders

Superior:—Meets Manubrium.

Inferior:—Joins Ensiform Cartilage.

Two Lateral:—At Sup. Angles we have demifacets for the cartilages of the second ribs. Succeeding angular depressions receive the cartilages of the third, fourth, fifth, and sixth ribs, and demifacets at the Inf. angles, the seventh.

Surfaces

Anterior:—Shows three transverse ridges which represent lines of fusion of the four original parts of the Gladiolus. The origin of the **Pectoralis Major M.** continues down over this surface.

Posterior:—Smooth. The transverse ridges show slightly. Near the lower margin the **Triangularis Sterni M.** is partially inserted.

SUMMARY

Anteriorly:—Ridges and origin Pectoralis Major.

Posteriorly:—Ridges and insertion Triangularis Sterni.

Laterally:—Facets second to seventh costal cartilages.

ENSIFORM CARTILAGE

The lowest and smallest piece of the Sternum. In youth it is entirely cartilaginous, but in the adult is more or less ossified above. It is triangular.

Superiorly:—Articulates with Gladiolus.

Inferiorly:—Attaches Linea Alba.

Laterally:—Demifacets for seventh costal cartilages at Sup. Angles.

Anteriorly:—Rough attaching the **Costo-Xiphoid Lig't.** and a partial origin of the **Rectus Abdominis M.** Lw [illegible]

Posteriorly:—Continues insertion **Triangularis Sterni M.**, and gives slight origin to **Diaphragm M.**

ARTICULATIONS

The Sternum articulates with the Clavicles, and with seven costal cartilages. The sternal segments form the intersternal joints.

COSTO-STERNAL

Seven cartilages are received by lateral facets on the Sternum.

Ligaments

Capsular:—Thin. Joins sternum around facets.

Ant. and Post. Costo-Sternal Lig'ts. are merely thickenings of the Capsule.

Type of Joints:—Arthrodial.

INTERSTERNAL

The Manubrium and Gladiolus are joined by a fibro-cartilage. Ant. and Post. Intersternal Lig'ts. strengthen the union.

A cartilage joins the Gladiolus and Ensiform. This commonly ossifies in the adult.

THE SKULL

The Skull is divided into the Cranium, or brain case, and the Face. Eight bones compose the former: (Frontal, two Parietals, Occipital, two Temporals, Sphenoid, and Ethmoid), and fourteen (two Malars, two Sup. Maxillae, two Lachrymals, two Nasals, Vomer, two Inf. Turbinals, two Palate, and the Inf. Maxilla) the latter. We study this complicated single structure through the individual bones, and the student is urged to gain the use of a disarticulated specimen, as many parts are undemonstrable in the articulated skull.

THE CRANIUM

The Vault is formed by the two Parietals, and parts of the Frontal, Sphenoid, Temporals, and Occipital. The Base, seen by looking down into the skull, the vaulted roof having been removed, shows three well-defined fossae transversely placed. The Posterior is the largest and deepest, and contains the Foramen Magnum: the Middle consists mainly of two lateral wings: and the Anterior and highest, though smaller, has much the same shape as the Posterior.

Frequent reference is made to the Cranial Nerves, which pierce the various bones of the skull. They originate in pairs from the base of the brain and are named from the order in which they arise. They are

1. Olfactory. 2tracts; [illegible]
2. Optic.
3. Motor Oculi. ant. lacerated fissure

4. Trochlear (Patheticus).
5. Trigeminal (Trifacial). sup [illegible] or [illegible] mx ophthmic
6. Abducent.
7. Facial. int and [illegible]
8. Auditory.
9. Glosso-pharyngeal.
10. Pneumogastric (Vagus). Post [illegible] foramen
11. Spinal Accessory.
12. Hypoglossal. [illegible] foramen

THE OCCIPITAL BONE

Forms the floor, and postero-lateral walls of the Posterior Fossa. For descriptive purposes three divisions may be made, they bound the **Foramen Magnum** which transmits the **Medulla Oblongata** and its membranes, the **Ant.** and **Post. Spinal A's., Vertebral A's.,** and **Spinal Accessory N.,** and **Occipito-Vertebral Lig'ts.,** and are:—

1. **BASILAR** 2. **CONDYLAR** 3. **SQUAMOUS**

BASILAR PROCESS

A solid quadrilateral piece of bone lying in front of the Foramen Magnum. Anteriorly, it fuses with the body of the Sphenoid, and laterally articulates with the Petrous portion of the Temporal.

Sup. Surface:—A broad central groove lodges the Medulla. Following the Lat. margins are two narrow grooves for the **Inf. Petrosal Sinuses.**

Inf. Surface:—The **Pharyngeal Tubercle,** attaching the **Sup. Constrictor M.** of the Pharynx lies in the mid line about half an inch in front of the Foramen Magnum. A slight depression, the **Pharyngeal Fossa** is occasionally seen just before the tubercle, and behind it we sometimes have the so-called Third Condyle for the tip of the Odontoid.

Laterally, rough areas receive the insertion of the **Rectus Capitis Anticus Major** and **Minor M.**

SUMMARY

Superiorly:—Grooves for Medulla and Inf. Petrosal Sinuses.

Inferiorly:—Pharyngeal Tubercle attaching origin Sup. Constrictor.
Insertion Rectus Capitis Anticus Major and Minor.

Anteriorly:—Fused with Sphenoid.

Posteriorly:—Foramen Magnum.

Laterally:—Petro-Occipital Suture.

CONDYLAR PORTION

The **Condylar Processes** are seen on the Inf. Surface of the Skull upon both sides of the Foramen Magnum. They articulate with the Lat. Masses of the Atlas. Tunneling above each one is the **Ant. Condyloid Foramen** which transmits the **Twelfth N.,** and usually the Meningeal branches of the Ascending Pharyngeal Vessels. Behind the condyles are the inconstant **Post. Condyloid Foramina,** each transmitting an **Emissary V.** Internally, the condyles are rough for attachment of the Check Lig'ts.

The **Jugular Processes** of the Occipital project out from the bases of the Condyles, and articulate with the Petrous portions of the Temporals. Each shows anteriorly a deep concavity, the **Jugular Notch** which forms the postero-lateral wall of the **Jugular,** or **Post. Lacerat-**

ed Foramen, completed by the Temporal. Connective tissue divides this foramen into three compartments:—

1. The anterior transmits the **Inf. Petrosal Sinus.**
2. The middle transmits the **Ninth, Tenth,** and **Eleventh N's.**
3. The posterior transmits the **Lat. Sinus.**

A low ridge behind it gives insertion to the **Rectus Capitis Lateralis M.** The internal openings of the Ant. and Post. Condyloid Foramina appear on the inside of the skull, and the broad groove for the Lat. Sinus terminates on the Sup. surface of the Jugular Process.

SUMMARY

Superiorly:—Ant. and Post. Condyloid Foramina.
Groove for Lat. Sinus.
Inferiorly:—Condyles for Atlas.
Ant. Condyloid Foramen.
Post. Condyloid Foramen.
Attachment Check Lig'ts.
Jugular Process. Insertion Rectus Capitis Lateralis.
Jugular Notch and Foramen.

SQUAMOUS PORTION

A four-sided plate of bone concave internally, forming the floor and back of the Post. Fossa, and bounding the Foramen Magnum behind.

Borders

At the terminations of the transverse ridge upon the inner surface are sharp angles upon the Lat. borders. They mark the point of junction of the Occipital and Mastoid Portion of the Temporal. Back of this is the serrated Parietal portion forming posteriorly a sharp angle with its fellow. The entire Parietal articulation is known as the **Lambdoid Suture.**

Surfaces

Internal and **Superior**:—Longitudinal and transverse ridges divide the bone into four fossae. The two superior receive the occipital lobes of the Cerebrum, the two inferior the hemispheres of the Cerebellum. The **Int. Occipital Protuberance** occuring at the intersection of the ridges, marks the meeting point of five sinuses **(Torcular Herophili)** the two **Lateral,** the **Sup. Longitudinal,** the **Straight,** and the **Occipital.** The **Straight** leaves no impress upon the bone. The Sup. arm of the cross is grooved to accommodate the **Sup. Longitudinal Sinus** and attaches by its margins the **Falx Cerebri.** The Inf. arm, or **Int. Occipital Crest** is grooved for the **Occipital Sinus,** and attaches by its margin the **Falx Cerebelli.** Near the Foramen Magnum this arm divides enclosing the triangular **Vermian Fossa** for the Vermis of the Cerebellum. The Lat. arms are grooved for the **Lat. Sinuses,** and attach the **Tentorium Cerebelli.**

Posterior or **Inferior**:—About the center is seen the **Ext. Occipital Protuberance** attaching the **Ligamentum Nuchae,** and a partial origin of the **Trapezius M.** From it a sharp line, the **Ext. Occipital Crest,** extends to the Foramen Magnum. Three curved lines radiate from the Protuberance.

1. *Superior* (or Highest):—A very faint roughness, often passing entirely above the Protuberance. It attaches the **Epicranial Aponeurosis,** which covers the smooth bone above, and gives partial origin to the **Occipitalis M.**

2. *Middle* (or Superior):—Distinct. It passes to the Mastoid Process, and from within outward gives an origin of the **Trapezius** and insertions to the **Sterno-Cleido-Mastoid** and **Splenius M.**

3. *Inferior:*—Runs out from the middle of the Crest. Between the Middle and Inferior Lines the **Complexus M.** inserts, and between the Inferior and the Foramen Magnum, from within outward, the **Rectus Capitis Posticus Minor** and **Major,** and the **Obliquus Superior M.**

SUMMARY

Borders articulate with Temporals and Parietals.

Superiorly—Sup. arm attaches Falx Cerebri.
" lodges Sup. Longitudinal Sinus.
Inf. arm attaches Falx Cerebelli.
" lodges Occipital Sinus. Vermian Fossa.
Lat. arms attach Tentorium Cerebelli.
" lodge Lat. Sinus.
Int. Occipital Protuberance and Torcular Herophili at intersection.
Four fossae, receiving lobes Cerebrum and Cerebellum.

Posteriorly:—Ext. Occipital Protuberance attaching Ligamentum Nuchae and origin Trapezius.
Three curved lines.

Muscular Attachments

Origin Trapezius.
" Occipitalis.
Insertion Sterno-Cleido-Mastoid and Splenius.
" Complexus.
" Rectus Capitis Posticus Minor.
" Rectus Capitis Posticus Major.
" Obliquus Superior.

THE TEMPORAL BONES

Two in number. They contain the organ of hearing, and are situated at the sides, and base of the skull. Three portions constitute the adult bone.

1. **SQUAMOUS** 2. **MASTOID** 3. **PETROUS**

1. SQUAMOUS

Principally a broad plate at the side of the skull, articulating above with the Parietal. It also extends a short distance in on the base of the Skull. A line following a marked fissure (Glaserian), and continued out to an elevation, the Supramastoid Crest, limits this part posteriorly. Antero-Inferiorly, the Squamosal articulates with the great wing of the Sphenoid. Superiorly, a bevelled edge overlaps the Parietal. (Squamous Suture).

It has two surfaces, Internal and External.

Int. Surface:—Helps form the Mid. Fossa and shows eminences and depressions for the convolutions of the Cerebrum, and long narrow grooves for branches of the **Mid. Meningeal A.**

Ext. Surface:—Forms the postero-lateral wall of the **Temporal Fossa**, giving origin to the **Temporal M.** A vertical groove for the **Deep Temporal A.** passes up behind the Zygomatic Process. Just above the **Ext. Auditory Meatus** the small **Spina Suprameatum** is seen. It is an important surgical landmark.

The **Zygomatic Process** forms the Post. part of the **Zygoma.** It arises by three roots from the lower Ext. surface.

Roots:—1. Anterior:—This is a rounded prominence, the **Eminentia Articularis,** at right angles to the Process, and in front of a deep fossa, the **Glenoid.** When the mouth is widely opened the Condyle of the lower jaw slips downward, and forward upon this root. Externally, it presents the small **Preglenoid Tubercle** attaching the **Ext. Lat. Lig't.** of the Jaw.

2. Middle:—Beginning at the **Postglenoid Tubercle** just in front of the Glaserian Fissure, it forms the outer margin of the Glenoid Fossa.

3. Posterior:—Continues the Sup. border of the Zygoma, passing back upon the Mastoid portion as the **Supramastoid Crest.** With the Sup. border it attaches the **Temporal Fascia.** Internal to this border, and above the Eminentia Articularis a grooved shelf lodges the **Temporal M.** The Inf. border and Int. Surface give partial origin to the **Masseter M.** Externally, the process is subcutaneous, and anteriorly joins the Zygomatic Process of the Malar to form the Zygoma. Posterior to the Eminentia Articularis is the deep **Glenoid Fossa** which has two parts.

1. Anterior or Articular Portion:—This is the *true* fossa. It is limited externally by the Post. root of the Zygomatic Process, and posteriorly, by a narrow cleft, the **Glaserian Fissure,** lodging the **Processus Gracilis** of the **Malleus,** and transmitting the **Tympanic branch** of the **Int. Maxillary A.** This part of the fossa articulates with the Condyle of the lower jaw.

2. Posterior, or Tympanic Portion:—Not truly part of the Squamosal, but conveniently described at this time since it forms the Post. wall of the Glenoid Fossa. From the Glaserian Fissure the **Tympanic Plate** extends

down and back. It forms the floor of the Tympanum or Mid. Ear, and the Ant. wall of the Ext. Auditory Canal. The rough outer margin is the **Auditory Process.** A downward extension often entirely surrounds the **Styloid Process,** and is called the **Vaginal Process.** The **Tympano-Mastoid** or **Auricular Fissure** separates the Auditory from the Mastoid Process, and gives passage to the **Auricular branch** of the **Tenth N.,** sometimes called **Arnold's N.**

The tip of the Parotid Gland lies on the Tympanic Portion.

SUMMARY

Articulations, Parietal, and Great Wing Sphenoid.

Internally:—Cerebral depressions, and grooves Mid. Meningeal A.

Externally:—Temporal Fossa. Origin Temporal.

Zygomatic Process.—Three Roots

1. Eminentia Articularis. Preglenoid Tubercle, attaching Ext. Lat. Lig't.
2. Outer boundary Glenoid Fossa. Postglenoid tubercle.
3. Supramastoid Crest attaches Temporal Fascia.

Glenoid Fossa.

Glaserian Fissure.

Anteriorly:—Articulation with Condyle.

Posteriorly:—Tympanic Plate, Auditory, and Vaginal Processes. Auricular Fissure.

2. MASTOID PORTION

This portion is situated posteriorly. A line following the Supramastoid Crest and terminating on the Post. margin of the Ext. Auditory Meatus marks its Inf. boundary.

Internally it consists of a small plate of bone behind the Petrosal.

Borders

Superior:—Anteriorly, makes an acute angle with the Squamosal, and throughout its entire extent articulates with the Parietal.

Posterior:—Articulates with the Occipital.

Surfaces

Internal:—An S-shaped groove for the **Lat. Sinus** (here often called **Sigmoid Sinus**), continued from the Occipital, runs down the Ant. margin. It gives off an **Emissary V.**, which passes through the small **Mastoid Foramen** in line with the crest of the Petrosal. The rest of the surface helps form the **Post. Fossa** for the Cerebrum.

External:—Chiefly Subcutaneous. The **Mastoid Process** is the most prominent feature. Internally, it contains the Mastoid air cells, and externally, continues from the Occipital the origin of the **Occipitalis M.**, and the insertions of the **Sterno-Cleido-Mastoid**, and **Splenius M.** Above these the **Auricularis Posterior M. (Retrahens Aureum)** arises, and below them the **Longissimus Capitis (Trachelo-Mastoid)** inserts.

Behind the base of the process is the Ext. opening of the **Mastoid Foramen.**

On the lower surface and internal to the process occurs the **Digastric Groove** or **Fossa,** giving origin to the **Post. Belly** of the **Digastric M.** External to this is a smaller groove for the **Occipital A.** Separating these we occasionally have an eminence, the **Paramastoid Process.**

SUMMARY

Articulations :—Parietal and Occipital.
Internally :—Groove for Lat. Sinus.
Mastoid Foramen.
Receives Cerebrum.
Externally :—Mastoid Process.
Origin Occipitalis.
" Auricularis Posterior.
Insertion Sterno-Cleido-Mastoid.
" Splenius.
" Longissimus Capitis.
Mastoid Foramen.
Digastric Groove. Origin Digastric.
Occipital Groove.

3. PETROUS PORTION

A triangular pyramid having its base between the Squamosal and Mastoid, and its apex internally.

	Surfaces :—	**Borders :—**
Base	Anterior	Superior
Apex	Posterior	Anterior
	Inferior	Posterior

Base :—Seen upon the outer surface of the Skull. It is entirely taken up by the **Ext. Auditory Meatus,** which is bounded above, by the Post. Root of the Zygoma, below and in front by the **Auditory Process,** and posteriorly by the Mastoid.

Apex:—Articulates with the Basilar Process of the Occipital. The Ant. border on first leaving the Apex helps form the **Mid. Lacerated foramen,** transmitting nothing; the Post. border, the **Jugular** or **Post. Lacerated Foramen.**

Surfaces

Anterior:—Forms the Post. boundary of the Mid. Fossa, and beginning at the Apex presents six points of interest:

1. The **Int. opening of the Carotid Canal,** transmitting the Int. Carotid A., at the extreme lower and inner margin.

2. A triangular depression immediately above it for the **Gasserian Ganglion.**

3. A small groove parallel to the Sup. border leads outward to a minute irregular foramen situated in about the middle of the surface. This is the **Hiatus Fallopii** and transmits the **Great Superficial Petrosal N.** from the Aqueductus Fallopii to the Mid. Fossa.

4. A minute opening below this, sometimes called the **Accessory Hitaus,** transmits the **Small Superficial Petrosal N.** from the Aqueductus Fallopii to the Mid. Fossa.

5. An eminence produced by the underlying **Sup. Semicircular Canal.** It makes a right angle with the Sup. border.

6. The **Tegmen Tympani,** a thin plate of bone roofing the Tympanum. It extends to the angle which the Sup. surface makes with the Squamosal.

SUMMARY

1. Carotid Canal.
2. Gasserian Ganglion.
3. Hiatus Fallopii.
4. Accessory Hiatus.
5. Eminence for Sup. Semicircular Canal.
6. Tegmen Tympani.

Posterior:—Forms part of the Ant. boundary of the Post. Fossa. The Sup. border separates it from the Ant. surface. Passing from within outward we have three points of interest:—

1. **Int. Auditory Meatus,** a large foramen placed about an inch from the Apex and transmitting the **seventh** and **eighth N's** and the **Auditory A.** This foramen leads into a short canal terminated by a bony plate, the **Lamina Cribrosa,** divided into an upper and lower portion by the **Falciform Crest.** The upper by a slit-like opening permits the passage of the **seventh** or **Facial N.** into the **Aqueductus Fallopii** or **Facial Canal,** which is therefore entirely inside of the petrosal. Small foramina in this division, and in the lower allow the **eighth** or **Auditory N.** to reach the Int. Ear.

2. The **Floccular Fossa,** a small depression just beyond the Meatus. It lodges a process of the **Dura Mater.**

3. **Aqueductus Vestibuli,** a foramen about one-half inch outside the Meatus placed beneath an overhanging shelf of bone near the Inf. border. It transmits the **Ductus Endolymphaticus.**

SUMMARY

1. Int. Auditory Meatus. Has:—
    - a. Lamina Cribrosa.
    - b. Falciform Crest.
    - c. Foramina.
2. Floccular Fossa.
3. Aqueductus Vestibuli.

Inferior:—Seen upon the base of the skull. The student should have no trouble in following the Suture which begins at the Apex against the Basilar Process and limits it anteriorly and posteriorly. From the apex outward we have fourteen points of interest.

1. A **quadrilateral area** at the Apex giving origin to the **Tensor Tympani** and **Levator Palati M.**

2. The Ext. opening of the **Carotid Canal.** This canal bends forward and inward almost at right angles. In imperfect specimens where the thin plate of bone, extending between the quadrilateral area above mentioned and the Post. edge of the Great Wing of the Sphenoid, is broken away, it appears as a deep groove communicating internally with the Mid. Fossa.

3. The **Aqueductus Cochleae** transmitting a small vein from the Cochlea, has its Ext. opening at the bottom of a depression in line with, and behind the Post. margin of the Carotid Canal.

4. The **Canalis Tympanicus**, a minute opening on the bony crest between the Jugular Fossa and the Carotid Canal, which transmits the **Tympanic branch** of the **ninth N.**, or **Jacobson's N.** from the Fossa into the Tympanum.

5. The **Canalis Auricularis** is an even smaller foramen on the outer wall of the Fossa. It transmits the **Auricular branch** of the **tenth N.**, or **Arnold's N.**, from the Fossa to the Ext. Ear.

6. The **Jugular Process**, which articulates with the Similar Occipital Process.

7. The **Jugular Fossa**, for the ampulla of the **Jugular V.**, is a large hollow external to and slightly behind the Carotid Canal, formed by the outer wall of the Jugular Foramen.

8. **Jugular Foramen** which transmits the **Inferior Petrosal Sinus**, the **Lateral Sinus**, the **ninth**, **tenth** and **eleventh N's.**

9. The **Styloid Process**, giving origin to the **Stylo-Glossus**, **Stylo-Pharyngeus**, and **Stylo-Hyoideus M.**, and attachment to the **Stylo-Hyoid** and **Stylo-Maxillary Lig'ts.**

10. The **Vaginal Process** of the Tympanic Plate often surrounds the Styloid Process.

11. The **Stylo-Mastoid Foramen** at the base of the Styloid Process gives egress to the **seventh N.**, and entrance to the **Stylo-Mastoid A.**

12. The **Auricular Fissure**, between the Tympanic Plate and Mastoid Process. It continues the passage of **Arnold's N.**

13. **Tympanic Plate**:—Posterior to Glenoid Fossa enclosing tympanum. See p. 157.

14. **Auditory Process**:—Ext. border of Tympanic Plate. See p. 158.

SUMMARY

1. Origin Tensor Tympani and Levator Palati.
2. Carotid Canal.

3. Aqueductus Cochleae.
4. Canalis Tympanicus.
5. Canalis Auricularis.
6. Jugular Process.
7. Jugular Fossa.
8. Jugular Foramen.
9. Styloid Process.
    - Origin Stylo-Glossus.
    - " Stylo-Pharyngeus.
    - " Stylo-Hyoideus.
    - Attachment Stylo-Hyoid Lig't.
    - " Stylo-Maxillary Lig't.
10. Vaginal Process.
11. Stylo-Mastoid Foramen.
12. Auricular Fissure.
13. Tympanic Plate.
14. Auditory Process.

BORDERS

Superior:—Seen on the inside of the skull. It is the crest of the pyramid and divides the Post. and Mid. Fossae.

Near the inner end a slight **notch** for the **fifth N** leads into the depression for the **Gasserian Ganglion.**

A shallow groove for the **Sup. Petrosal Sinus** runs along it, to the edges of which the **Tentorium Cerebelli** attaches.

Anterior:—Two parts.

1. Inner:—Articulates by a serrated suture with the Great Wing of the Sphenoid, and fronts upon the Mid. Lacerated Foramen.
2. Outer:—Joins Squamosal.

The **Canalis Musculotubarius** lies beneath the junction of these two portions. It is seen by looking across the skull upon the Inf. Surface just in front of the Ext. opening of the Carotid Canal. The **Processus Cochleariformis** is attached to its outer wall, marking two divisions. The upper transmits the tendon of the **Tensor Tympani M.**; the lower **Eustachian Tube.** The **Canal of Huguier** passes between this opening and the inner end of the Glaserian Fissure. It transmits the **Chorda Tympani** branch of the **Seventh N.**

Posterior:—Two parts.

1. Inner:—Articulates with the Basilar Process of the Occipital, and helps form the groove for the **Inf. Petrosal Sinus.**

2. Outer:—Helps form the Jugular Fossa, and by articulating with the Occipital, completes the foramen.

SUMMARY

Borders

Superiorly:—Attachment Tentorium Cerebelli.
Grooves for Sup. Petrosal Sinus, and Fifth N.

Anteriorly:—Articulation with Sphenoid.
Mid. Lacerated Foramen.
Canalis Musculotubarius.
  1. Tensor Tympani M.
  2. Processus Cochleariformis.
  3. Eustachian Tube.
Canal of Huguier—Chorda Tympani N.

Posteriorly:—Articulation with Basilar Process.
Inf. Petrosal Sinus.
Jugular Fossa and Foramen.

THE SPHENOID BONE

This bone is placed at the anterior part of the base of the skull. It articulates with all the other cranial bones and a thorough understanding of its position gives a key to the architecture of the entire skull. It presents for examination:—

1. **BODY**
2. 2 **LESSER WINGS**
3. 2 **GREATER WINGS**
4. 2 **PTERYGOID PROCESSES**

BODY

Looking down into the cranial fossae the body is found in the mid-line. It fuses posteriorly with the Basilar Process, and ends anteriorly at the Cribriform Plate of the Ethmoid. From the front spring the Lesser Wings, from the sides the Great Wings, and from the base the Pterygoid Processes.

We describe **six surfaces:**

Superior:—Just behind a prominent projection, the Crista Galli of the Ethmoid, a pointed process, the **Ethmoidal Spine,** marks the Ant. limit of this surface. If the finger is passed over the plane surface behind the spine **two shallow parallel grooves** separated by a longitudinal ridge may be felt. They lodge the **Olfactory lobes** on their way forward to the Cribriform Plate. A transverse ridge appears next. It extends between the upper margins of the two foramina (optic) and forms the Ant. lip of up a groove for the **Optic Commissure.** The

Olivary Eminence is seen in the mid-line behind this groove. It limits a saddle-shaped fossa anteriorly, and occasionally shows tubercles or points laterally. These are the **Mid. Clinoid Processes,** and attach the **Tentorium Cerebelli.** The **Pituitary Fossa,** or **Sella Turcica** lodges the **Pituitary Body. The Dorsum Sellae,** a square plate of bone, limits the saddle posteriorly. It fuses below with the Basilar Process and thus assists in limiting the Post. Fossa. Two projections, the **Post. Clinoid Processes,** spring from the upper angles, and attach the **Tentorium Cerebelli.** Below these on both sides we have a slight groove for the **Sixth N.**

SUMMARY

1. Ethmoidal Spine.
2. Longitudinal Ridge.
3. Longitudinal Grooves for the Olfactory Tracts.
4. Transverse ridge.
5. Transverse Groove for Optic Commissure.
6. Olivary Eminence.
7. Mid. Clinoid Processes attaching Tentorium Cerebelli.
8. Pituitary Fossa lodging Body.
9. Dorsum Sellae.
10. Post. Clinoid Processes attaching Tentorium Cerebelli.
11. Notches for Sixth N.

Inferior:—Seen upon the lower surface of the skull just anterior to the Basilar Process. In front it presents a triangular spine, the **Rostrum,** continuous with the Sphenoidal Crest upon the Ant. surface. It articulates with the Sup. border of the Vomer, forming a grooved suture or Schindelysis. Projecting inward towards the Rostrum two shelves of bone, the **Vaginal Processes,** form grooves which receive the edges of the Vomer. The **Pterygo-Palatine Groove** lies against the root of the Vaginal Process. It is converted into a canal by the Spenoidal Process of the Palate, and passing back through the Nares, transmits the **Pterygo-Palatine Vessels and N.** from the Spheno-Maxillary Fossa to the base of the Skull.

SUMMARY

1. Rostrum. Schindelysis with Vomer.
2. Vaginal Processes.
3. Pterygo-Palatine Groove.

Anterior:—This surface is unseen unless the student has a disarticulated specimen. It articulates with the Ethmoid, and presents in the mid-line the **Sphenoidal Crest** extending between the Ethmoidal Spine above and the Rostrum below. This Crest joins the Perpendicular Plate of the Ethmoid. On both sides of it we have openings of the air cells. In the articulated skull these are continuous with similar cells in the interior of the Lat. masses of the Ethmoid. There are usually two of these irregular cavities separated by a vertical partition. The Sphenoidal Foramina give them communication with the back of the nose.

The Lat. margins of the surface show an irregular edge for articulation with the Os Planum of the Ethmoid and below, with the Sphenoidal Process of the Palate.

SUMMARY

1. Sphenoidal Crest, articulating with the Vertical Plate of Ethmoid.
2. Openings of Sphenoidal Air Cells.
3. Edges articulating with the Os Planum, and Sphenoidal Process of Palate.

Posterior:—Fused with the Basilar Process.

[illegible]

Lateral:—Posteriorly, a groove leads down into the Int. opening of the Carotid Canal. This opening is completed antero-externally by a thin plate of bone, the **Lingula,** which touches the Petrosal, and postero-internally a slight tubercle, the **Petrosal Process,** performs the same service. The groove continues forward, and then up, making an "S" curve. It is named from the **Cavernous Sinus,** which, with the **Int. Carotid A.,** it lodges. The Great Wings spring from the lower part of the Lat. Surfaces, and the Lesser Wings from the Upper Ant. Part.

SUMMARY

1. Cavernous Groove.
2. Lingula.
3. Petrosal Process.
4. Origin Lesser Wings.
5. " Great Wings.

LESSER WINGS

These flat triangular structures arise by two roots from the front of the Lat. Surfaces of the body, and extend outward above the Great Wings to form part of the Ant. limit of the Middle Fossae. The upper root is broad and flat, the lower short and round. Between them we have the **Optic Foramen** transmitting the **Optic N.** and the **Opthalmic A.** from the Mid Fossa to the orbit.

Each wing presents:—

Surfaces

Superior:—Flat. Supports Cerebrum and helps form Ant. Fossa.

Inferior:—Forms Post. part of the roof of the orbit and bounds the **Spenoidal Fissure,** or **Ant. Lacerated Foramen** above. This foramen transmits into the orbit, the **Third, Fourth, Sixth,** and **Ophthalmic Division** of the **Fifth N.,** filaments of the **Cavernous Plexus** of the **Sympathetic N.,** the **Orbital branch** of the **Mid. Meningeal A.,** the **Recurrent branch** of the **Lachrymal A.,** and the **Ophthalmic V.** Its further boundaries are given on p. 172.

Borders

Anterior:—Articulates with the Post. border of the horizontal plate of the Frontal.

Posterior:—Free. Forms part of the Ant. boundary of the Mid. Fossa, and is received into the **Fissure of Sylvius** in the Cerebrum. It terminates internally in the rounded **Ant. Clinoid Process** attaching the **Tentorium Cerebelli.**

SUMMARY

Superiorly:—Free.

Inferiorly:—Roof of Sphenoidal Fissure.

Anteriorly:—Articulation with Frontal.

Posteriorly:—Ant. Clinoid Process, attaching Tentorium Cerebelli.

GREAT WINGS

Concave shelves of bone which spring from the Lat. surfaces of the body, and form most of the floor and sides of the Mid. Fossa. Looking down into the Skull their outer boundary may be traced as follows:—

From the Ext. Margin of the Mid. Lacerated Foramen the suture with the Petrosal extends outward. It passes over into that with the squamosal and goes forward toward the end of the ridge which limits the Mid. Fossa anteriorly. It then bends inward and passes below the Lesser Wing.

On the outer and Inf. surface of the skull the same suture crosses the bone just inside the Eminentia Articularis, and passes up through the Temporal Fossa to end in a sharp angle where the Squamosal, Parietal, and Frontal surround it. From the apex of this angle the border passes forward toward the orbit, and then joins the Orbital Process of the Malar in a vertical articulation. The remainder of the Great Wing is seen on the inside of the orbit where it forms the larger part of the outer wall.

We describe three surfaces:

1. **Superior or Cerebral.** 2. **External or Temporo-Zygomatic.** 3. **Anterior or Orbital.**

1. **Superior, or Cerebral:**—Antero-internally we have the irregular triangle of the **Sphenoidal Fissure,** which is bounded above by the Lesser Wing, internally by the body, and below by the Great Wing. The **Foramen Rotundum** is immediately behind it, and transmits the **Sup. Maxillary Division** of the **Fifth N.** into the Spheno-Maxillary Fossa. Slightly outside, and about a half an inch behind this, the **Foramen Ovale** is seen,

which opens upon the base of the Skull and transmits the **Inf. Maxillary Division** and **Motor Root** of the **Fifth N.**, and the **Small Meningeal A.** The **Foramen Spinosum,** intermediate in size, lies behind and outside of it, and transmits the **Mid. Meningeal A.**, from the Zygomatic Fossa up into the Mid. Fossa.

The inconstant **Foramen Vesalii** is a minute canal between the Foramen Ovale and the Foramen Rotundum. It is occupied by an **Emissary V.**

The Post. border of the Great Wing forms the Ant. margin of the **Mid. Lacerated Foramen** which is bounded internally by the body of the Sphenoid, and posteriorly by the apex of the Petrosal. In the recent state this foramen is filled with cartilage.

The concave outer part of the surface receives the convolutions of the Temporo-Sphenoidal Lobe of the Cerebrum and shows grooves for branches of the Mid. Meningeal A.

SUMMARY

1. Post. boundary Sphenoidal Fissure.
2. Foramen Rotundum.
3. Foramen Ovale.
4. Foramen Spinosum.
5. Foramen Vesalii.
6. Ant. boundary Mid. Lacerated Foramen.
7. Depressions for Cerebrum.
8. Grooves for Mid. Meningeal A.

2. **External or Temporo-Zygomatic:**—The **Pterygoid,** or **Infratemporal Ridge,** passing forward from the Preglenoid Tubercle of the Squamosal, divides this sur-

face into an upper, temporal and a lower, zygomatic portion. The ridge ends anteriorly in an angular tubercle, the **Infratemporal Spine.**

a. **Sup. or Temporal Portion:**—Anteriorly, it helps form the knife-like **Malar Crest** articulating with the orbital process of the Malar. Superiorly, we have articulations with the Frontal, and Ant. Inf. Angle of the Parietal, and posteriorly with the Squamosal. The **Temporal M.** arises from this part of the Sphenoid as it does from all the rest of the Temporal Fossa.

b. **Inf. or Zygomatic Portion:**—Inside the Pterygoid Ridge a flat surface gives partial origin to the **Ext. Pterygoid M.** Internally to this the Ext. openings of the Foramina Ovale and Spinosum are seen, and that of the Foramen Vesalii if present. The surface ends posteriorly in the **Spine** of the **Sphenoid,** which attaches the **Spheno-Maxillary,** improperly called the Int. Lat. Lig't. of the Jaw. It presents a slight groove internally for the **Chorda Tympani N.**

SUMMARY

Sup. Portion:—Articulates with Squamosal, Parietal, Frontal, and Malar, and gives origin to the Temporal.

Inf. Portion:—Origin Ext. Pterygoid.
Foramen Ovale.
Foramen Spinosum.
Foramen Versalii.
Spine attaching Spheno-Maxillary Lig't.
Groove for Chorda Tympani N.

Between the two Portions Pterygoid Ridge and Infratemporal Spine.

3. **Anterior or Orbital**:—Appears as a quadrilateral plate on the inside of the orbit, where it forms most of the outer wall. The surface is pierced by a varying number of **Ext. Orbital Foramina** transmitting branches of the **Deep Temporal A.** It has four borders.

a. Superior:—Articulates with the horizontal plate of the Frontal.

b. Inferior:—Forms the outer margin of the **Spheno-Maxillary Fissure**, a deep cleft seen in the back of the floor of the orbit.

c. Internal:—Forms the lower margin of the Sphenoidal Fissure. At its highest point there is a small notch for a branch of the **Ophthalmic A.**, and slightly in front of the middle, a sharp Spine for partial origin of the **Ext. Rectus M.**

d. External:—Contributes one side of the Malar Crest articulating with the orbital process of the Malar.

PTERYGOID PROCESSES

In the disarticulated specimen these irregular processes are seen upon the Inf. surface, arising at the union of the Great Wings and Body. In the intact skull they form the Lat. boundaries of the Post. Nares, and anteriorly in their highest part, the Post. boundaries of the Spheno-Maxillary Fossae, which open upon the floor of the orbits by the fissures of the same name. The lower Ant. limit is in articulation with the Palate Bone, and cannot be seen. Each process presents two plates separated by a deep hollow.

Int. Pterygoid Plate:—Projects backward on the inner side of the process. Its tip is prolonged downward into the delicate **Hamular Process,** around which plays the tendon of the **Tensor Palati M.,** and from which the **Sup. Constrictor M.** of the Pharynx takes a slight origin. This origin extends up the sharp Post. border.

The plate has two surfaces:

1. **Internal:**—Forms the outer Post. limit of the Nares. About half-way down we find a slight groove above a tubercle. This lodges the **Eustachian Tube.** If the skull is held so that the student can look through the Nares, a small foramen may be seen upon the Ant. margin of the Mid. Lacerated Foramen and about in line with the Post. edge of the Int. Plate. This is the Post. opening of the **Vidian Canal** which transmits the **Vidian Vessels** and **N.** from the base of the skull into the Spheno-Maxillary Fossa. The Vaginal Process mentioned upon the Inf. surface of the body is often considered to spring from the root of this plate.

2. **External:**—Forms the inner wall of the hollow, the **Pterygoid Fossa,** which separates the plates.

SUMMARY

Inferiorly:—Hamular Process. Grooved by Tensor Palati. Origin Sup. Constrictor.

Posteriorly:— " " "

Internally:—Outer boundary Post. Nares.
Groove for Eustachian Tube.

Externally:—Inner boundary Pterygoid Fossa.

At the root:—Vaginal Process.
Vidian Canal.

Ext. Pterygoid Plate:—Has two surfaces.

1. **Internal**:—Forms the outer wall of the **Pterygoid Fossa.**

2. **External**:—Comprises part of the inner wall of the Zygomatic Fossa and completes the origin of the **Ext. Pterygoid M.**

If the student has a disarticulated Sphenoid he will find the two plates separated by a deep notch inferiorly. This is the **Pterygoid Notch.** In the articulated skull it is occupied by the tuberosity of the Palate Bone, which thus completes the lower part of the **Pterygoid Fossa.** An oblique ridge joins the two plates near their origin, splitting off the small **Scaphoid Fossa** which gives origin to the **Tensor Palati M.** The **Int. Pterygoid M.** arises from the Pterygoid Fossa.

Antero-superiorly, the Pterygoid Process forms the smooth post. wall of the Spheno-Maxillary Fossa, and shows openings of the Foramen Rotundum above and the Vidian Canal below. By passing straws through the foramina these openings may be ascertained. Below this free area we have articulation with the Sphenoidal process, and then with the tuberosity of the Palate Bone.

Before leaving the Sphenoid we may summarize its articulations as follows:—

Anteriorly:—Ant. borders of Lesser wings with horizontal plate of Frontal, and Ethmoidal Spine with Cribriform Plate of Ethmoid, Sphenoidal Crest with Vertical Plate and Lat. margins with the Os Planum. The Malar Crests meet the Malars, and the Pterygoid Processes the Sphenoidal Processes and Tuberosities of the Palate Bones.

Posteriorly:—Great Wings with Petrosal Apices and Body with Basilar Process.

Laterally:—Great Wings with the Frontal, Ant. Inf. Angles of the Parietals, and the Squamosals.

Infero-Anteriorly:—Body with the Vomer by the Rostrum, and groove internal to the Vaginal Processes.

THE FRONTAL BONE

This bone forms the Ant. part of the Vault of the Cranium, and most of the floor of the Ant. Fossa. It is divided into Vertical and Horizontal Portions.

VERTICAL PORTION

This consists of the thicker rounded part which extends back from the orbits, and forms the forehead. We describe a continuous border, and two surfaces.

Border:—Anteriorly, between the orbits a rough area articulates with Sup. borders of the Nasal Bones. At the inner margin of the orbit the border makes a sharp bend backward, forming the **Int. Angular Process,** which articulates with the Nasal Process of the Sup. Maxilla. It then curves over the orbit as the **Supraorbital Arch,** terminating at the Malar as the **Ext. Angular Process.** Just beyond the Int. Angular Process a notch or foramen gives passage to the **Supraorbital Vessels and N.** From the Ext. Angular Process the border bends straight back articulating with the Sup. border of the Temporo-Zygomatic part of the Great Wing, and the Squamosal. From the Post. Angle the border goes straight across articulating with the two Parietals in the **Coronal Suture,** and then passes forward and across the orbit as described.

Surfaces

Ext. or Ant. Surface:—Just above the Nasal articulation we have a faint prominence, the **Glabella.** Crossing this from before backward, and extending along the mid line to the Post. margin of the bone a faint line marks the remnant of the **Inter-frontal** or **Metopic Suture** which unites two Frontal bones in early life. The **Superciliary Ridges** pass up and out from the Glabella. They give origin to the **Orbicularis Palpebrarum** and **Corrugator Supercilii M.** From the Ext. Angular Process the **Temporal Ridge** arches backward. It is continued over the Parietal and joins the Supramastoid Crest of the Squamosal. An upper and lower ridge are often seen, the former attaching the Temporal Fascia and being the true Temporal Ridge; the latter beginning the origin of the **Temporal M.** Below, the roughened surface of the bone forms part of the boundary of the Temporal Fossa, and gives partial origin to the **Temporal M.**

Directly above the orbits and almost half-way to the back of the surface, the **Frontal Eminences** appear. These are very prominent in early life, but are hardly noticeable in the adult skull.

SUMMARY

Glabella, and Metopic Suture.
Superciliary Ridges. Origin Orbicularis Palpebrarum.
" Corrugator Supercilii.
Temporal Ridges. Attach Temporal Fascia.
Temporal Fossae. Origin Temporal M.
Frontal Eminences.

Int. or Post. Surface:—Eminences and depressions accommodate the convolutions of the Cerebrum and branching grooves receive the ramifications of the **Mid. Meningeal A.** The **Frontal Crest** is a grooved ridge in the mid line. In it is the Sup. Longitudinal Sinus, and attached to its margins the Falx Cerebri. At the base of the Crest is the **Foramen Caecum,** transmitting an emissary vein. On both sides of the Crest several irregular fossae lodge the **Pacchionian Bodies.**

HORIZONTAL PORTION

This portion—more delicate—forms most of the floor of the Ant. Fossa, and the roofs of the orbits. In the disarticulated specimen, we at once notice the wide **Ethmoidal Notch** between the orbits. The borders of this Notch articulate with the Lat. Masses of the Ethmoid. It is filled in by the Cribriform Plate. These borders anteriorly show openings into the **Frontal Air Cells,** occupying the interior of the lower central part of the Vertical Portion. Back of these openings there are several small hollows which close in certain of the **Ethmoidal Air Cells** when the bones are in place. There are also two grooves on each of these Lat. margins which are converted into the **Ant.** and **Post. Ethmoidal Canals** by the articulation with the Lat. Masses of the Ethmoid. See p. 186 and 187.

The **Nasal Spine** projects downward from this between the openings of the Sphenoidal Cells, and forms a posterior support for the inner margins of the Nasal Bones and an anterior one for the Median Plate of the Ethmoid. The **Orbital Plates** are lateral to the Ethmoidal Notch. Above they present depressions for the convolutions of the Cerebrum, and below form the arched roofs of the orbits. Near the Int. Angular Processes each shows a slight fossa where the **pulley** of the **Sup. Oblique M.** is attached, and near the Ext. Angular Process another **fossa** for the **Lachrymal Gland.** The post. border articulates with the Lesser Wing.

SUMMARY

1. Ethmoidal Notch. Filled by Cribriform Plate and articulating with Lat. Masses of Ethmoid.
    - a. Frontal Air Cells.
    - b. Ethmoidal Air Cells.
    - c. Ant. Ethmoidal Canal.
    - d. Post. Ethmoidal Canal.
2. Nasal Process.
3. Nasal Spine articulating with the Nasals and Median Plate of Ethmoid.
4. Orbital Plates.
    - a. Depression for the Cerebrum.
    - b. Roof of the orbit.
        - 1. Fossa for Pulley Sup. Oblique M.
        - 2. " " Lachrymal Gland.
    - c. Articulation Lesser Wings.

THE PARIETAL BONES

Two bulging quadrilateral sheets of bone completing the sides and roof of the skull. Each presents four borders, two surfaces, and four angles.

Borders

Superior:—Straight. Forms the **Sagittal Suture** by articulating with the opposite Parietal.

Inferior:—Sharp and concave. Anteriorly it articulates with the Great Wing, then with the Squamosal, and posteriorly with the Mastoid.

Anterior:—Slightly concave. Near the Ant. Inf. Angle the border overlaps the Frontal. The rest of the joint is serrated. The entire articulation (both Parietals with Frontal) is called the **Coronal Suture.**

Posterior:—Convex. Forms a serrated suture with the Occipital. The entire articulation (both Parietals with Occipital) is known as the **Lambdoid Suture.**

Surfaces

Internal:—Concave. A shallow **groove** runs along the line of the Sagittal Suture. It lodges the **Sup. Longitudinal Sinus,** and by its lips attaches the **Falx Cerebri.** Near the middle the groove may show the minute and inconstant **Parietal Foramen** transmitting an Emissary V. Parallel to and about an inch from the Sagittal Suture depressions or pits lodge the **Pacchionian Bodies.** They are variable in number. Branches of the **Mid. Meningeal A.** mark the surface, and there are the characteristic elevations and depressions for the Cerebrum.

SUMMARY

1. Groove for the Longitudinal Sinus. Attaches Falx Cerebri.
2. Parietal Foramen.
3. Pits for Pacchionian Bodies.
4. Grooves for Mid. Meningeal A.
5. Depressions for Cerebrum.

External:—Convex. The apex of the convexity is called the **Parietal Eminence.** It is not prominent save in the young. Above this we may find the Ext. opening of the Parietal Foramen. Below it the **Temporal Ridge** crosses the surface, continuing the ridge described, upon the Frontal, and meeting the Supramastoid Crest behind. This ridge often appears as two parallel curved lines, the **upper** attaching the **Temporal Fascia** and the **lower** limiting the origin of the **Temporal M.** which comes from the rough surface below, where the Parietal enters into the formation of the Temporal Fossa.

SUMMARY

1. Parietal Eminence.
2. Parietal Foramen.
3. Temporal Ridge attaching Fascia.
4. Rough surface. Origin Temporal.

ANGLES

1. **Ant. Superior:**—Formed by the intersection of the Coronal and Sagittal sutures **(Bregma).** In the foetus the articulation is incomplete. A space exists covered with connective tissue and called the Ant. Fontanelle.

2. **Ant. Inferior**:—Formed by the Ant. and Inf. borders. Here the Frontal, Great Wing, and Squamosal meet **(Pterion)**. In the foetus we have a second membranous space, the Ant. Lat. Fontanelle.

3. **Post. Superior**:—Formed by the intersection of the Lambdoid and Sagittal Sutures **(Lambda)**. In the foetus we have the Post. Fontanelle.

4. **Post. Inferior**:—Formed by the Inf. and Post. borders. It meets the Mastoid and Occipital (**Asterion**). The Post. Lat. Fontanelle occurs at this point.

THE ETHMOID BONE

In the articulated skull this bone straddles the back part of the Nasal Cavity, and from its upper horizontal or Cribriform Plate sends down a sheet of bone to join the Vomer, and complete the Nasal Septum.

It lies in front of the Sphenoid, behind the bones of the Face, and below the Frontal. It is intermediate in position between the bones of the face and cranium.

We describe:—

1. **HORIZONTAL, OR CRIBRIFORM PLATE.**
2. **PERPENDICULAR, OR MEDIAN PLATE.**
3. **TWO LATERAL MASSES.**

Horizontal, or Cribriform Plate:—Fills the Ethmoidal Notch in the Frontal. It is seen upon the floor of the Ant. Fossa, as the perforated depressed surfaces on either side of a sharp crest. This is the **Crista Galli,** an upward prolongation of the Median Plate. The Lat. margins of the Cribriform Plate meet the horizontal plate of the Frontal which partially covers the Lat. Masses. The two depressions lodge the **Olfactory Lobes** of the **Cerebrum,** and form part of the roof of the Nasal cavity. The **Olfactory N's.** pass down through the eighteen or twenty foramina in the floor. Close to its front, and on each side of the Crista Galli a **longitudinal slit** transmits the **Nasal N.** down into the nose. The outer margins of the plate present the openings of the

Ant. and Post. Ethmoidal Canals, which run horizontally outward grooving the Sup. surface of the Lat. Masses and open on the inner wall of the orbit.

The Anterior transmits the **Nasal N.** from the orbit to the fossa, and the **Ant. Ethmoidal Vessels;** the **Posterior,** the **Post. Ethmoidal Vessels.**

SUMMARY

1. Grooves for Olfactory Lobes and Foramina for Olfactory N's.
2. Slits for Nasal N's.
3. Ant. Ethmoidal Canal.
4. Post. Ethmoidal Canal.

Perpendicular, or Median Plate:—This appears in the Ant. Fossa as the **Crista Galli** attaching the **Falx Cerebri** with the **Foramen Caecum** just in front of it. Below the Cribriform Plate the large septal part of the Median Plate is seen. Unless the student has a bisected skull, or a disarticulated Ethmoid he will be unable to examine this plate satisfactorily. It has five borders.

a. The Superior (imaginary) joins the Cribriform Plate.

b. The Antero-Superior articulates with the Frontal Spine, and sometimes the inner margins of the Nasals.

c. The Antero-Inferior attaches the upper part of the triangular cartilage of the Septum.

d. The Postero-Inferior joins the Vomer.

e. The straight Post. border articulates with the Sphenoidal Crest of the Sphenoid.

The surfaces of the plate are simply right and left. They show grooves near the Sup. border for the **Olfactory N.'s.**

Lateral Masses:—Roughly cuboidal in shape. They join the outer edges of the Cribriform Plate, and are roofed over by the horizontal plate of the Frontal. They hang down parallel with the Median Plate and form part of the Lat. walls of the nasal cavity. Air cells riddle them, making their texture most delicate. These are usually placed in three groups; anterior, middle, and posterior.

Surfaces

1. **Superior:**—Unseen in articulated specimen. It articulates with the horizontal plate of the Frontal and shows openings of air cells and grooves for the **Ant. and Post. Ethmoidal Canals,** corresponding to those upon the Frontal.

2. **Inferior:**—The inner portion of this surface is the free lower border of the **Mid. Turbinal,** which may be seen by looking into the Nasal Fossae. The outer portion is the lower border of the **Orbital Plate.** Anteriorly, it articulates with the Sup. Maxilla, which closes some small air cells, and posteriorly with the orbital process of the Palate Bone closing more air cells.

3. **Anterior:**—Unseen. The cavities of the Ant. air cells are closed by the Lachrymal Bone, and nasal process of the Sup. Maxilla.

4. **Posterior:**—Unseen. Articulates with the Ant. surface of the body of the Sphenoid, and slightly with the orbital process of the Palate Bone.

5. **Internal:**—Forms the upper and back part of the outer wall of the nasal fossa.

The Ethmoidal contribution to this fossa is marked approximately, in front, by a perpendicular line through the Ant. end of the Mid. Turbinal; and in back, by a second line parallel to this about a quarter of an inch from the Post. end of the Inf. Turbinal. It reaches downward almost to the upper convex margin of this last bone.

A series of small grooves near the upper margin lodge the Olfactory N's as they come through the Cribriform Plate. The **Sup. Turbinal bone** in the Post. upper corner bears some of these. It is **part** of the Ethmoid, simply an eminence presenting a sharp lower border which overhangs an oblique fossa, the **Sup. Meatus** of the nose. At the upper end of this Meatus we find the opening of the **Post. Ethmoidal Air Cells.** The **Mid. Turbinal,** also **part** of the Ethmoid, is a larger structure just below and parallel to the lower border of the Sup. Turbinal. The two Turbinals are continuous above the Sup. Meatus. Anteriorly, where the Mid. Turbinal passes into the flat wall of the nasal cavity a slight elevation, the **Agger Nasi,** is often seen. With the **Uncinate Process** it is said to represent another rudimentary Turbinal. The Mid. Turbinal covers the **Mid. Meatus,** and should be broken away to permit examination of this cavity. Extending down and back from the Ant. end of the Mid. bone we have the delicate **Uncinate Process** which articulates below with the Ethmoidal Process of the Inf. Turbinal. Posterior to this is the **Bulla,** a round projection with an opening in its center for the **Mid. Ethmoidal Air Cells.** It is also considered a rudimentary Turbinal. The **Infundibulum** is the deep groove between the Uncinate Process and Bulla. Its crescentic opening into the Mid. Meatus is called the **Hiatus Semilunaris.** The upper end of the Infundibulum presents a foramen communicating with the Frontal and Ant. Ethmoidal Air Cells; the lower and outer side, one into the Antrum of Highmore in the Sup. Maxilla.

6. **External, or Os Planum:**—Seen upon the inner wall of the orbit. It is a quadrilateral plate whose borders are:—

a. Superior:—Articulates with the Orbital process of the Frontal. The Ext. opening of the Ant. and Post. Ethmoidal Canals are seen just below this border.

b. Inferior:—Anteriorly, articulates with the Sup. Maxilla and behind with the orbital process of the Palate Bone.

c. Anterior:—Articulates with the Lachrymal.

d. Posterior:—Articulates with body of Sphenoid.

SUMMARY OF LAT. MASS.

Superiorly:—Openings for Air Cells.
Grooves for Ant. and Post. Ethmoidal Canals.
Articulates with horizontal plate of Frontal.

Inferiorly:—Inner portion free.
Outer portion articulates with the Sup. Maxilla and orbital process of the Palate.

Anteriorly:—Openings for air cells closed by articulation Lachrymal and nasal process Sup. Maxilla.

Posteriorly:—Articulates Sphenoid, and orbital process Palate.

Internally:—Grooves for Olfactory N's.
Sup. Turbinal and Sup. Meatus with opening of Post. Ethmoidal Air Cells.
Mid. Turbinal and Agger Nasi.
Mid. Meatus.
a. Uncinate Process, articulates Inf. Turbinal.
b. Bulla, with opening into Mid Air Cells.
c. Hiatus Semilunaris and Infundibulum.
Opening into (1) Frontal and Ant. Ethmoidal Air Cells; and (2) Antrum of Highmore.

Externally:—Above, articulates orbital process Frontal and shows Ant. and Post. Ethmoidal Canals.
Below, articulates Sup. Maxilla and Palate.
In front, articulates Lachrymal.
Behind, articulates Sphenoid.

THE FACE

Formed by jaws, orbits, and nose. The Sphenoid and Ethmoid are therefore concerned in it as they form the outer and inner walls of the orbits and a considerable share of the nasal cavity. Fourteen bones construct the face only.

THE SUPERIOR MAXILLARY BONES

These form the face below the Malars, the floor of the orbits, the main part of the outer walls of the nose, most of the hard palate, and support the teeth of the upper jaw. Each presents a **Body,** and **four Processes,** the Malar, Nasal, Alveolar, and Palatal.

Body

A hollow triangular pyramid with its base as the Lat. Surface of the Nasal cavity, and its apex at the Malar articulation. A large air space, the **Antrum of Highmore,** or Maxillary Sinus, occupies the interior and follows the bone in shape. It opens through the **Infundibulum** into the nasal fossa. The roots of the first and second molar teeth cause elevations in its floor.

Surfaces

1. **Superior, or Orbital:**—A triangular plate which forms most of the floor of the orbit.

There are three borders. The internal begins at the nasal process by forming the **Lachrymal Notch** which becomes a canal for the **Lachrymal Duct** when the

Lachrymal Bone is in articulation. Behind this it articulates with the Os Planum, and then with the orbital process of the Palate Bone. The Ant. border is between the nasal and malar processes and forms the lower front margin of the orbit. The postero-external border is free, extending back from the malar process as the inner boundary of the **Spheno-Maxillary Fissure.**

The surface included by these borders forms the roof of the Antrum of Highmore. Near the Lachrymal Groove a faint depression gives origin to the **Inf. Oblique M.** of the eye. In the mid line there is a deep slit, the **Infraorbital Groove,** for the passage of the **Infraorbital N. and A.** Anteriorly this groove divides into **two canals.** The larger transmits the **Infraorbital N.** and **A.** out upon the face. The other is the **Ant. Dental Canal** and transmits the **Ant. Sup. Dental N.** and **Vessels** to the front teeth of the upper jaw. The **Mid. Sup. Dental N.** leaves the Infraorbital groove by a foramen near its Post. end and passes to the premolar teeth.

SUMMARY

Borders:—Internal, presents Lachrymal Notch.
Articulates Lachrymal, Os Planum and Orbital process Palate.
Anterior, forms Ant. limit Orbit.
Posterior, forms Ant. limit Spheno-Maxillary Fissure.

Surface:—Origin Sup. Oblique.
Infraorbital Groove.
Ant. Dental Foramen.
Foramen for Mid. Sup. Dental N.

2. **Anterior, or Facial**:—Forms the front wall of the pyramid, and Antrum. At the lower margin of the Ant. opening of the nasal cavity the junction of the two Maxillae forms the **Ant. Nasal Spine.** Below and external to this over the incisor teeth we have the shallow **Incisor** or **Myrtiform Fossa,** giving origin above to the **Compressor Naris M.,** and below to the **Depressor Alae Nasi M.** The rounded vertical **Canine Eminence** separates this fossa from the large **Canine Fossa** from which the **Levator Anguli Oris M.** arises. Just below the orbit is the Ext. opening of the **Infraorbital Canal.** A thin line above this gives origin to the **Levator Labii Superioris M.**

SUMMARY

1. Ant. Nasal Spine.
2. Incisor Fossa. Origin Compressor Naris.
   " Depressor Alae Nasi.
3. Canine Eminence.
4. Canine Fossa. Origin Levator Anguli Oris.
5. Infraorbital Foramen.
6. Origin Levator Labii Superioris.

3. **Posterior, or Zygomatic**:—A dull ridge passes down from the Malar articulation, and separates this surface from the anterior.

It forms the Post. wall of the pyramid and Antrum. In the lower back part there is the rough bulging **Tuberosity,** giving partial origin to the **Int. Pterygoid M.,** and perforated by two or three **Post. Dental Foramina,** transmitting the **Post. Sup. Dental Vessels** and **N's** to the molar teeth. Internal to the tuberosity, the Maxilla forms the Ant. wall of the **Spheno-Maxillary Fossa,** the opening of which into the orbit is called the **Spheno-Maxillary Fissure.** A second fissure, the **Pterygo-Maxillary,** lies between the Maxilla and Pterygoid Process, and forms a second outlet for the important structure in the fossa. The **Post. Palatine Canal** grooves this portion of the bone in the articulation with the Palate. It transmits the **Descending Palatine A.**, and the **Large Post. Palatine N.** (also called Ant. Palatine) from the Spheno-Maxillary Fossa to the roof of the mouth.

The Ant. boundary of the Zygomatic Fossa is contributed by this Zygomatic surface.

SUMMARY

1. Tuberosity. Origin Int. Pterygoid.
2. Post. Dental Foramina.
3. Ant. boundary Zygomatic Fossa.
    Pterygo-Maxillary Fissure.
    Spheno-Maxillary Fossa.
4. Groove for Post. Palatine Canal.
5. Articulation with perpendicular plate of Palate Bone.

4. **Internal or Nasal:**—Seen upon the inside of the nose. It is limited below by the shelving **Palatal Process.** Above, it articulates with the Os Planum and behind with the Palate Bone, and anteriorly has a free margin. In the disarticulated bone there is a very large opening in the upper and back part into the Antrum. This is much reduced in the articulated skull. In front of it we have the smooth **Lachrymal Groove** for the duct. Anterior to this groove is the **Inf. Turbinate Crest** articulating with the **Inf. Turbinal.** It runs horizontally back-

ward, broken by the Lachrymal Groove, and ends upon the perpendicular plate of the Palate Bone. The Inf. Turbinal covers the **Inf. Meatus** into which the Lachrymal Duct opens.

SUMMARY

1. Opening into Antrum.
2. Lachrymal Groove.
3. Inf. Turbinate Crest articulating bone.
4. Inf. Meatus. Opening Lachrymal Duct.

PROCESSES

1. **Malar:**—The apex of the pyramidal body. It is rough, and serrated for articulation with the Malar. The **Masseter M.** has slight origin upon its lower border.

2. **Nasal** or **Ascending:**—Passes up upon the inner margin of the orbit to join the Int. angular process of the Frontal. It has two borders and two surfaces.

Ant. Border:—Articulates with corresponding Nasal Bone.

Post. Border:—Thicker. It is grooved for the Lachrymal Duct. The Inner lip of the groove articulates with the Lachrymal Bone, the outer is free, and forms the orbital margin. Near its junction with the Sup. surface of the body there is a sharp spine, the **Lachrymal Tubercle,** which meets the tip of the Hamular Process of the Lachrymal Bone.

Inf. Surface:—Forms the Ant. part of the wall of the nasal fossa. The **Crista Ethmoidalis** is an oblique ridge, which articulates with the front of the Mid. Turbinal. The smooth lower surface helps to form the Nasal Vestibule.

Ext. Surface:—Concave. Near the margin of the orbit it gives origin to the **Orbicularis Palpebrarum**, and bound up with it the **Tendo Oculi M.** External to these the **Levator Labii Superioris Alaeque Nasi M.** arises.

SUMMARY

Superiorly:—Articulates Int. Angular Process Frontal.

Anteriorly:—Articulates Nasal.

Posteriorly:—Articulates Lachrymal.
Groove for Lachrymal Duct.
Lachrymal Tubercle.

Internally:—Crista Ethmoidalis articulates Mid. Turbinal.

Externally:—Origin Orbicularis Palpebrarum.
Origin Tendo Oculi.
Origin Levator Labii Superioris Alaeque Nasi.

3. **Alveolar**:—This is the thick lower border of the bone. It shows **eight cavities** or **alveoli** for the upper teeth, which are, from within outward: **Mid.** and **Lat. Incisors, Canine, two Bicuspids,** and **three Molars.** The first set of milk teeth lack the bicuspids and one molar. The **Buccinator M.** arises from the outer margin as far forward as the second bicuspid.

4. **Palatal**:—A horizontal shelf of bone forming the Ant. part of the roof of the mouth, and floor of the nasal cavity. Its convex outer margin joins the body of the bone just above the Alveolar Process. The Int. border is raised and joins that of the opposite bone, making the **Nasal Crest,** which articulates with the lower border of the Vomer. Anteriorly, this crest becomes the **Incisor Crest,** which is prolonged into the **Ant. Nasal Spine,** and

attaches the Cartilage of the Septum. The Post. border articulates with the horizontal process of the Palate Bone. There are two surfaces:

a. *Superior:*—Forms the smooth concave floor of the nose. At the front we have the openings of the **Foramina of Stenson,** which will be described with the lower surface.

b. *Inferior:*—Rough. Forms the roof of the mouth. In the disarticulated specimen a groove may be seen crossing the inner border just above and behind the incisor teeth. Articulation with the opposite bone makes of this the **Ant. Palatine Canal** which is seen to have a single large opening below. Above, in the nose, there are two, so that the entire canal resembles a "Y" with the arms pressed closed together. These arms are the **Foramina of Stenson,** and transmit the **Ant. Palatine A's.** to the nose. The **Foramina of Scarpa** are slightly Lat. to the opening of the Ant. Palatine Canal, but open into it above and transmit the **Naso-Palatine N's.** The *left* of these minute foramina is always *farther* forward than the right.

Where the Palatal Process joins the body a **groove** lodges the **Descending Palatine A.** and the **Large Post. Palatine N.** as they pass forward from the lower orifice of the Post. Palatine Canal.

SUMMARY

Borders:—1. External:—Imaginary, joins Alveolar Process.

2. Internal:—Articulates opposite bone.
Nasal Crest articulates Vomer.
Incisor Crest attaches cartilage.
Ant. Nasal Spine.

3. Posterior:—Articulates horizontal plate Palate Bone.

Surfaces:—Superior: Floor of nose. Anteriorly, openings Foramen Stenson.

Inferior:—Ant. Palatine Canal.
Foramina Scarpa.
Groove for Descending Palatine A. and Ant. Palatine N's.

THE PALATE BONES

In the articulated skull these bones are almost entirely closed from view. They form some of the back of the outer walls of the nose, part of the roof of the mouth and the floor of the orbit. They also enter into the formation of three fossae, the Zygomatic, Spheno-Maxillary, and Pterygoid. They are shaped like the letter "L" and therefore present a Horizontal and a Vertical Plate.

HORIZONTAL PLATE

Joins the palatal process of the Sup. Maxilla, and forms the back of the hard palate. There are four borders and two surfaces.

Borders

Anterior:—Articulates with palatal process Sup. Maxilla.

Posterior:—Forms the free Post. edge of the hard palate and attaches the soft palate.

Internal:—Articulates with the opposite bone forming the Post. part of the Nasal Crest which meets the lower border of the Vomer. Behind, this crest forms the **Post. Nasal Spine,** which attaches the **Azygos Uvulae M.**

External:—Joins Vertical Plate.

Surfaces

Superior:—Continues the smooth floor of the nose.

Inferior:—Rough. A transverse ridge near the back attaches the aponeurosis of the **Tensor Palati M.** Near the Postero-external corner we have the lower orifice of the **Post. Palatine Canal,** really only a groove upon the Palate bone, since the Sup. Maxilla completes it. Near it may be several small openings, the **Accessory Palatine Canals** for the **Accessory Post. Palatine N's.**

Near the orifice of the Large Post. Palatine Canal is the relatively constant **Small Post. Palatine Canal** which transmits the **Small Post. Palatine N.**

SUMMARY

Anteriorly:—Articulates Sup. Maxilla.
Posteriorly:—Free. Attaches soft palate.
Internally:—Nasal Crest. Articulates Vomer.
Post. Nasal Spine attaches Azygos Uvulae.
Superiorly:—Smooth.
Inferiorly:—Ridge attaching Tensor Palati.
Large Post. Palatine Canal.
Accessory Palatine Canal.
Small Post. Palatine Canal.

VERTICAL PLATE

Cannot be appreciated without a disarticulated bone. It helps form the outer wall of the nose and the inner wall of the Spheno-Maxillary Fossa, but even in these situations is defined with difficulty. It also has two surfaces and four borders.

Surfaces

Internal:—Free. Lies between the Sup. Maxilla in front and the Pterygoid Process behind. It is crossed by two ridges, the **Sup. Turbinated Crest** very near the top, which attaches the Mid. Turbinal, and the **Inf. Turbinated Crest** for the Inf. Turbinal. Above the upper ridge the Palate may contribute slightly to the Sup. Meatus; between the two, it shares in the Mid. Meatus; and below the Inferior, in the Inf. Meatus.

External:—Largely articular. Near the top a small vertical portion forms a slight part of the inner wall of the Spheno-Maxillary Fossa, and shows the upper part of the groove which becomes the Post. Palatine Canal when it reaches the articular part of the bone. The articular portion extends forward as a thin plate. This largely covers the opening of the Antrum on the inner surface of the Sup. Maxilla. The inner surface of this plate is the part of the bone which forms the outer wall of the nose. Along the line of the Post. Palatine Canal we have a firm articulation with the Maxilla.

SUMMARY

Internally:—Part of the outer wall nose.
Sup. Turbinated Crest attaching Mid. Turbinal.
Inf. Turbinated Crest attaching Inf. Turbinal.
Portions of the three Meatuses.

Externally:—1. Non-articular portion.
Forms slight part inner wall of Spheno-Maxillary Fossa.
Groove for Post. Palatine Canal.
2. Articular Portion.
Joins Sup. Maxilla and helps form Post. Palatine Canal.

Borders

Anterior:—Thin. Articulates with the Sup. Maxilla. That part of it which extends over the opening of the Antrum is often called the **Maxillary Process.**

Posterior:—Serrated to articulate with the Pterygoid

Process. At its junction with the Post. border of the horizontal plate we have the **Pyramidal Process** or **Tuberosity** which projects between the Pterygoid Plates of the Sphenoid, and articulates with them. The free non-articular portion of this process makes the upper part of the **Pterygoid Fossa** (p. 177), and helps give origin to the **Int. Pterygoid M.**

Superior:—Shows a deep notch bounded by two processes. The anterior is the **Orbital.** Superiorly, this process is smooth and free. It forms a very small part of the floor of the orbit near the back and inner side. Externally, a second smooth area contributes a little of the upper, inner wall of the Spheno-Maxillary Fossa. The other surfaces are in articulation. Antero-inferiorly, it meets the Maxilla. A concavity upon the antero-internal surface closes one or two air cells on the Inf. surface of the Lat. Mass of the Ethmoid. Posteriorly, the process touches the Sphenoid upon its Ant. surface.

The Post. Process is the **Sphenoidal.** It is a delicate plate of bone projecting back and in. Superiorly, a narrow surface joins the Inf. surface of the body of the Sphenoid, and completes the **Pterygo-Palatine Canal** leading from the Spheno-Maxillary Fossa to the base of the skull and transmitting the **Pterygo-Palatine Vessels and N's.** Internally, or inferiorly, a free surface forms a slight part of the roof of the nasal fossa. Externally, a ridge separates an Ant. free portion which helps bound the Spheno-Maxillary Fossa, and a rough Post. portion which articulates with the Ant. edge of the Ext. Pterygoid Plate. The notch between the two processes is called the **Spheno-Palatine.** It has been converted into a **foramen** of the same name by the articulation of the

Post. surface of the Orbital Process with the Ant. surface of the Sphenoid and by that of the Sup. surface of the Sphenoidal Process with the Inf. surface of the Sphenoid. A communication is thus given between the Spheno-Maxillary Fossa and the Nasal Chamber. It transmits the **Naso-Palatine A. and N.**

SUMMARY

Ant. Border:—Articulates Sup. Maxilla.
Post. Border:—Articulates Pterygoid Process.
  Tuberosity.
  Makes part of Pterygoid Fossa, and gives origin Int. Pterygoid.
Sup. Border:—I. Orbital Process.
  a. Floor of orbit.
  b. Inner wall Spheno-Maxillary Fossa.
  c. Antero-inferiorly Maxilla.
  d. Antero-internally Ethmoid.
    1. Forms inner surface Spheno-Max. Fossa.
    2. Articulates Pterygoid Process.
  II. Spheno-Palatine Notch.
  III. Sphenoidal Process.
  a. Superiorly meets body Sphenoid, forming Pterygo-Palatine Canal.
  b. Roof of Nasal Fossa.
  c. Two portions.

THE VOMER

This thin plate of bone completes the lower and back part of the nasal septum. It has four borders and two surfaces.

Borders

Superior:—Thick. A deep groove with two prominent lips, the **Alae,** constitutes it. These enclose the rostrum of the Sphenoid and reach out above the Vaginal Processes of that bone. The articulation is a schindelysis.

Inferior:—Articulates with the Nasal Crest formed by the two Sup. Maxillae in front, and the two Palate Bones behind.

Anterior:—Runs obliquely forward and downward. The back and upper part articulates with the perpendicular plate of the Ethmoid. The lower front portion attaches the triangular cartilage of the Septum.

Posterior:—Free.

Surfaces

Simply right and left. Each presents a **longitudinal groove** accommodating the **Naso-Palatine A. and N.**

THE LACHRYMAL BONES

Complete the inner walls of the orbit, filling in the space between the Os Planum behind and the Nasal Process of the Sup. Maxilla in front. Each is a thin scale of bone and presents four borders and two surfaces.

Borders

Superior:—Short. It articulates with the Int. Angular Process of the Frontal.

Inferior:—The **Lachrymal Crest** on the outer surface ends here, and divides the border into two portions. The anterior, is prolonged down as the Descending Process which articulates with the Inf. Turbinal and helps to form the wall of the Lachrymal Canal. The posterior articulates with the Orbital plate of the Sup. Maxilla.

Anterior:—Articulates with the Nasal Process.

Posterior:—Articulates with the Os Planum.

Surfaces

Internal:—Shows a groove corresponding to the Lachrymal Crest on the outer surface. In front of this groove the surface forms the Ant. part of the Mid. Meatus, and behind articulates with the Lat. Mass of the Ethmoid, completing some of the Ant. Air Cells.

External:—The Lachrymal Crest forms the Post. lip of the Lachrymal Groove, lodging in this position the **Lachrymal Duct.** The Crest gives origin to the **Tensor Tarsi M.** and ends as the **Hamular Process** which articulates with the Lachrymal Tubercle of the Sup. Maxilla and completes the foramen for the duct. Behind the Crest a smooth surface helps form the inner wall of the orbit.

SUMMARY

Superiorly:—Articulates Frontal.

Inferiorly:—Descending Process articulates Inf. Turbinal, Post. Portion with Sup. Maxilla.

Anteriorly:—Articulates Nasal Process.

Posteriorly:—Articulates Os Planum.

Internally:—Ant. part forms Mid. Meatus.
Post. part articulates Lat. Mass Ethmoid.

Externally:—Lachrymal Crest. Origin Tensor Tarsi.
Lachrymal Groove. Lodges Duct.
Hamular Process articulates Lachrymal Tubercle.

THE INFERIOR TURBINATED BONES

Seen upon the inside of the nasal fossae attached to about the middle of the Lat. walls, and separating the Mid. and Inf. Meatuses. Each presents two borders and two surfaces.

Borders

Superior:—The attached portion. Anteriorly, it articulates with the Inf. Turbinated Crest upon the Nasal process of the Sup. Maxilla, and posteriorly with the one upon the vertical plate of the Palate Bone. Between these two there are three processes:

1. *Lachrymal:*—Anterior and highest. Its tip articulates with the descending process of the Lachrymal, and its margins with the sides of the groove upon the Sup. Maxilla. The Lachrymal Canal is thus closed in.
2. *Maxillary:*—Bends back and in and joins with the maxillary process of the Palate Bone in helping to close the opening of the Antrum.
3. *Ethmoidal:*—Joins the Uncinate Process of the Ethmoid. It is inconspicuous.

Inferior:—Convex and free.

Surfaces

Internal:—Rough.

External:—Forms part of the Inf. Meatus.

THE NASAL BONES

Form the bridge of the nose, and the Int. part of the roof of the nasal cavity. Each presents four borders, and two surfaces.

Borders

Superior:—Jagged, and short. Articulates with the Frontal.

Inferior:—Attaches Lat. cartilage of nose.

Internal:—Articulates with opposite bone, and with the Nasal Spine of the Frontal, and occasionally with the Median Plate of the Ethmoid.

External:—Articulates with Nasal Process of Sup. Maxilla.

Surfaces

Internal:—Forms part of the roof of the nose and shows a longitudinal groove for the Nasal N.

External:—Smooth. It gives slight origin to the **Orbicularis Palpebrarum M.**

THE MALAR BONES

Placed at the sides of the face, forming the prominences of the cheeks. Each has two surfaces and four processes.

Surfaces

External:—Smooth and subcutaneous. Near the upper margin there is an opening, the **Malar Foramen** transmitting the **Temporo-Malar N.** Along the orbit it gives origin to the **Orbicularis Palpebrarum M.** and near the middle to the **Zygomaticus Minor M.** in front and **Major M.** behind. Near the lower border there is a slight roughness giving origin to the **Masseter M.**

Internal:—Shows two parts separated by the oribital process. The anterior helps form the Ext. wall of the orbit. It has the upper opening of the **Malar Foramen.** The Posterior, much larger, forms the Ant. boundary of the Temporal Fossa above, and part of the Zygomatic Fossa below. This portion gives slight origin to the **Temporal** and **Masseter M.** Anterior to it is a rough triangular surface articulating with the Malar Process of the Sup. Maxilla.

SUMMARY

Articulates with four bones, the **Sphenoid, Frontal, Sup. Maxilla** and **Temporal.**

External:—Malar Foramen.
Origin Orbicularis Palpebrarum.
Origin Zygomaticus Minor.
Origin Zygomaticus Major.
Origin Masseter.

Internal:—Anteriorly, Malar Foramen.
Orbital Process.
Posteriorly, helps form Temporal and Zygomatic Fossae and gives origin to Temporal and Masseter.
Triangular articulation Sup. Maxilla.

Processes:—1. Frontal:—Thick. It articulates with the Ext. Angular process of the Frontal.

2. Maxillary:—The rough space which joins the Sup. Maxilla.

3. Zygomatic:—Joins the Zygomatic Process of the Temporal, completing the Zygoma. Its lower margin gives partial origin to the **Masseter M.**

4. Orbital:—Forms the front of the outer wall of the orbit, joining the Malar Crest of the Sphenoid. Its tip reaches the Ext. Angular Process of the Frontal and its lowest point the Sup. Maxilla. Near the back part there is often a smooth non-articular surface which forms the outer front margin of the Spheno-Maxillary Fissure.

THE INFERIOR MAXILLARY BONE

The lower jaw is formed by a single bone which develops in two halves. These fuse and remain symmetrical. We therefore describe one-half. This consists of the Body stretching back from the line of fusion of the bone, and the Ramus, a large right-angled projection at the back.

BODY

A half horseshoe, convex anteriorly. A ridge, the **Symphysis Menti,** marks the point of union of the two halves. It ends below in the **Mental Tubercle.** From this point to the angle each half presents two borders and two surfaces.

Borders

Superior:—Forms the Alveolar process and presents eight alveoli for the lower teeth. The **Buccinator M.** takes partial origin from the back and outer edge.

Inferior:—Rounded.

Surfaces

Internal:—Just back of the Symphysis we have four tubercles (Genial), two on each half. The **Sup. pair** of **Genial Tubercles** give origin to the **Genio-Glossus M.,** the Inf. pair to the **Genio-Hyoid M.** The **Int. Oblique Line** or **Mylo-Hyoid Ridge,** passes backward from a point just behind the Sup. Genial Tubercle and gives origin to the **Mylo-Hyoid M.** Near the back, where it joins the alveolar border, a small rough area gives slight origin to the **Sup. Constrictor M.,** and attaches the **Pterygo-Mandibular Lig't.** Above the inner end of the line, and just external to the Genial Tubercles, there is a shallow **fossa** which lodges the **Sublingual Gland.** Below this a rough oval area gives origin to the **Ant. Belly** of the **Digastric M.** Back of this there is an oblong depression, the **Submaxillary Fossa** for the **Submaxillary Gland.** It often extends upon the Ramus.

External:—Above the Mental Tubercle and lateral to the Symphysis we have the **Incisor Fossa** giving origin to the **Levator Menti M.** The **Mental Foramen** external to this gives egress to the **Mental N.** and **Vessels,** the terminations of the Inf. Dentals. The **Ext. Oblique Line** passes below this foramen, starting at the Mental Tubercle and ending opposite the termination of the Internal. It gives origin to the **Depressor Labii Inferioris,** and **Depressor Anguli Oris M.,** and insertion to the **Platysma Myoides M.**

SUMMARY OF BODY

Superiorly:—8 Alveoli for teeth. Origin Buccinator.
Inferiorly:—Transverse Groove for Facial Vessels.
Internally:—Sup. Genial Tubercles. Origin Genio-Glossus.
Inf. Genial Tubercles. Origin Genio-Hyoid.
Mylo-Hyoid Ridge. Origin Mylo-Hyoid.
" " Origin Sup. Constrictor.
" " Attaches Pterygo-Maxillary Lig't.
Fossa for Sublingual Gland.
Fossa for Submaxillary Gland.
Rough area for origin Ant. Belly Digastric.

Externally:—Incisor Fossa. Origin Levator Menti.
Mental Foramen.
Ext. Oblique Line. Origin Depressor Labii Inferioris.
" " " Origin Depressor Anguli Oris.
" " " Insertion Platysma Myoides.

RAMUS

A flat plate of bone making almost a right angle with the body in early adult life. It has four borders and two surfaces.

Borders

Anterior:—Thin above, and thick below. The Ext. Oblique Line runs into it, and often the Int. Oblique Line does likewise, forming two distinct lips. The lower part of this border is fused with the body.

Posterior:—Passes from the angle to the Condyle. In the lower part it attaches the **Stylo-Maxillary Lig't.**

Superior:—Presents two processes separated by a deep notch.

a. **Coronoid**:—This is the anterior. It is non-articular. Its entire Int. and most of the Ext. surface give insertion to the **Temporal M.** The Masseteric insertion sometimes extends up on it.

b. **Condyloid**:—The posterior. An oblong articular surface surmounts it, and fits the Glenoid Fossa of the Temporal. Below this we have a narrow Neck which attaches the **Capsular Lig't.** of the articulation. A tubercle at the outer side receives the **Ext. Lat. Lig't.** Upon the front and inner side of the process we have the **Digital Fossa** for the insertion of the **Ext. Pterygoid M.**

The **Sigmoid Notch** lies between the processes.

Inferior:—Free. A transverse groove crosses it, in which lie the **Facial A.** and **V.** The **Angle** is formed by the junction of the Post. and Inf. borders.

Surfaces

Internal:—Helps to bound the Zygomatic Fossa, forming its outer wall. The **Inf. Dental Foramen,** transmitting the **Inf. Dental Vessels and N.** into the **Inf. Dental Canal,** is at once seen. The **Inf. Maxillary Spine** or **Lingula** forms its Ant. margin and attaches the **Spheno-Mandibular Lig't.** Just below this begins the **Mylo-Hyoid Groove,** lodging the **Mylo-Hyoid Vessels and N.** A rough area reaching to the angle and behind the groove gives insertion to the **Int. Pterygoid M.**

External:—The lower three-fourths is slightly rough for the insertion of the **Masseter M.** The angle of the jaw, or **gonion** usually projects externally.

SUMMARY RAMUS

Posteriorly:—Attaches Stylo-Maxillary Lig't.

Superiorly:—1. Coronoid Process. Insertion Temporal.
2. Condyloid Process. Articulates Temporal Bone.
Neck attaches Capsular Lig't., and tubercle the Ext. Lat. Lig't.
Digital Fossa. Insertion Ext. Pterygoid.
3. Sigmoid Notch.

Inferiorly:—Angle. Groove for Facial A. and V.

Internally:—Outer wall Zygomatic Fossa.
Inf. Dental Foramen.
Lingula. Attaches Int. Lat. Lig't.
Mylo-Hyoid Groove.
Insertion Int. Pterygoid.

Externally:—Insertion Masseter.

THE TEMPORO-MANDIBULAR ARTICULATION

The upper surface of the Condyle of the Lower Jaw articulates with the Glenoid Fossa and Eminentia Articularis of the Temporal Bone.

Ligaments

1. **Capsular**:—Attaches around the Glenoid fossa and articular eminence above and around the neck of the condyle below. One strengthening band is observed.

a. **Ext. Lateral**:—Runs from the preglenoid tubercle and Post. end of the Zygoma to a tubercle on the outer side of the Condyle.

2. **Spheno-Mandibular**:—Passes from the Spine of the Sphenoid to the Lingula of the Inf. Maxilla. It is separate from the Capsule.

3. **Stylo-Maxillary**:—Fibres from the Cervical Fascia, which run between the styloid process of the Temporal and the angle of the Inf. Maxilla.

An Inter-articular Fibro-Cartilage is present. Its edges are attached to the Capsule.

Type of Joint:—Ginglymus.

THE HYOID BONE

A second horseshoe-shaped bone situated behind and below the Inf. Maxilla, and above the Larynx, with which it is closely connected. It does not articulate with any bone. We describe a Body, Greater Cornua and Lesser Cornua. These last spring from the extremities of the body. Until late in life they are connected with it by cartilage or by synovial joints, but finally fuse solidly.

BODY

Forms the central and front part of the bone. It presents two borders and four surfaces.

Sup. Border:—Rounded. Attaches the **Thyro-Hyoid membrane,** and laterally, the lower parts of the origin of the two **Hyo-Glossi M.**

Inf. Border:—Gives insertion to the two **Sterno-Hyoid M.,** and external to these to the two **Omo-Hyoids.**

Ant. Surface:—Convex. A dull tubercle in the center marks the intersection of vertical and horizontal ridges. With little reference to these the following muscles insert in pairs upon the surface: **Genio-Glossus, Genio-Hyoid, Mylo-Hyoid, Stylo-Hyoid,** and **Omo-Hyoid.**

Post. Surface:—Smooth and concave.

Lat. Surfaces:—In the young specimen these are largely occupied by facets for the Greater Cornua. The two **Thyro-Hyoids** find slight insertion upon the upper part.

GREATER CORNUA

These structures spring from the Lat. surfaces of the body, and project back and up, ending in small knobs to which the **Thyro-Hyoid Lig'ts.** are attached. The inner surface of each is smooth. The outer attaches the remainder of the insertion of the **Hyo-Glossus M.** The upper border gives slight origin to the **Mid. Constrictor M.**, and the lower to the **Thyro-Hyoid M.**

LESSER CORNUA

These are small spines rising from the upper border of the body at the junction with the Greater Cornua. They attach the **Stylo-Hyoid Lig'ts.**

FOSSAE AND FORAMINA

THE ORBITS

Each orbit is a cone-shaped cavity with its base anterior and its apex at the Optic Foramen. The roof is formed by the horizontal plate of the Frontal; the inner wall by the Lachrymal, the Os Planum, the orbital process of the Palate bone and a slight portion of the Lat. surface of the body of the Sphenoid; the floor, by the Sup. surface of the Sup. Maxilla and the orbital process of the Malar; and lastly, the outer wall by the orbital surface of the Great Wing and orbital process of the Malar. The Ant. opening or base of the orbit is enclosed by a regular ridge contributed by the Frontal, the Nasal Process of the Sup. Maxilla, its body, and the Malar.

Two fissures, the Sphenoidal and Spheno-Maxillary, communicate with it. The optic Foramen enters at the apex and the inner wall shows the Ant. and Post. Ethmoidal Foramina, and the beginning of the Lachrymal Canal. Superiorly, the Supraorbital Notch or Foramen marks the Ant. border. Upon the floor there are the Infraorbital Canal, and, more anteriorly, the orifice of the Malar Foramen.

THE TEMPORAL FOSSAE

Bounded:—Superiorly, by the Temporal Ridge passing from the Ext. Angular Process of the Frontal to the Post. Root of the Zygomatic Process of the Temporal; inferiorly and externally, by the Zygoma; anteriorly, by the Malar and Malar Crest of the Great Wing; inferiorly and internally, by the Pterygoid Ridge of the Great

Wing. The floor is formed by the Malar, the Great Wing, the Frontal, the Parietal, and the Squamosal. The fossa contains the Temporal M.

THE SPHENO-MAXILLARY FOSSAE

Bounded:—Anteriorly, by the Post. surface of the Sup. Maxilla; posteriorly, by the Ant. surface of the root of the Pterygoid Process; internally and superiorly, by the Vertical Plate of the Palate Bone, its processes, and a slight portion of the Inf. surface of the Sphenoid, which roofs over the Spheno-Palatine Notch. The Fossa contains the spheno-maxillary portion of the Int. Maxillary A., and its branches, the Sup. Maxillary division of the Fifth N., Meckel's Ganglion and its branches. Two large fissures open into it, the *Spheno-Maxillary,* largely from the orbit and slightly from the Zygomatic Fossa, transmitting the Sup. Maxillary N. and its Orbital branch, the Infraorbital Vessels, and Ascending branches from Meckel's Ganglion; and the *Pterygo-Maxillary,* transmitting branches of the Int. Maxillary A. Seven canals communicate with it. They are the *Vidian,* the *Foramen Rotundum* the *Pterygo-Palatine,* the *Spheno-Palatine,* the *Large Post. Palatine,* the *Accessory Palatine,* and the *Small Post. Palatine.* The *Sphenoidal Fissure* may also be said to enter it in the back and upper part.

THE ZYGOMATIC FOSSAE

Bounded:—Anteriorly, by the tuberosity of the Sup. Maxilla; posteriorly, by the Eminentia Articularis and Great Wing; Superiorly, by the Pterygoid Ridge; inferiorly, by the Alveolar process of the Sup. Maxilla; internally, by the Ext. Pterygoid Plate, and externally, by the Ramus of the Inf. Maxilla. It contains the two Pterygoid and the Temporal M., the second part of the Int. Maxillary A., and the Inf. Maxillary Division of the Fifth N. with its branches. The *Pterygo-Maxillary* and *Spheno-Maxillary Fissures* communicate with it, and the *Foramen Spinosum, Foramen Ovale, Middle Lacerated Foramen, Carotid Canal* and *Jugular Foramen* open into it.

THE NASAL FOSSAE

The roof is formed by the Nasals, and the Cribriform Plate of the Ethmoid; the inner wall, by the Septum, which comprises the triangular cartilage anteriorly, then the Vomer, Nasal Spine of the Frontal, and lastly the perpendicular plate of the Ethmoid; the floor, by the palate processes of the Sup. Maxillae and the horizontal plates of the Palate Bones; the outer wall, by the Lachrymal, the Sup. Maxilla, the Vertical plate of the Palate Bone and the Int. Pterygoid Plate of the Sphenoid.

The fossae open anteriorly by the Ant. Nares, which are bounded above by the Nasals; laterally and below, by the Sup. Maxilla. The Post. Nares communicate with the pharynx and are bounded above by the body of the Sphenoid, internally by the Vomer, below by the horizontal plate of the Palate Bone, and externally by the Int. Pterygoid Plate of the Sphenoid.

The three Turbinals divide the fossae into the Superior, Middle, and Inferior Meatuses. The first contains openings of the Sphenoidal and Post. Ethmoidal Air Cells; the second, of the Frontal, Ant. Ethmoidal, and Antrum through the Infundibulum, and of the Mid. Ethmoidal upon the Bulla; the third, of the Lachrymal or Nasal Duct.

FORAMINA OF THE SKULL

NAME.	SITE.	COMMUNICATES BETWEEN.	TRANSMITS.
Foramen Magnum.	Posterior to Basilar Process of Occipital.	Post. Fossa and Base of Skull.	Medulla Oblongata and its membranes. Ant. and Post. Spinal A. Vertebral A. Spinal Accessory N. Occipito-Vertebral Lig't.
Ant. Condyloid.	Ant. to Occipital Condyles.	Post. Fossa and Base of Skull.	Hypo-Glossal, or 12th Cranial N. Meningeal branches of Ascend. Pharyngeal A.
Post. Condyloid.	Post. to Occipital Condyles.	Post. Fossa and Base of Skull.	Emissary Vein.
Post. Lacerated or Jugular Foramen.	In suture between Jugular Processes of Temporal and Occipital.	Post. Fossa and Base of Skull.	Glossopharyngeal, or 9th Cranial N. Pneumogastric, or 10th Cranial N. Spinal Accessory, or 11th Cranial N. Inf. Petrosal Sinus. Lateral Sinus.
Glaserian Fissure.	Limits articular portion of Glenoid fossa.	Base of Skull and Middle Ear.	Tympanic branch of Int. Maxillary A. Processus Gracilis of the Malleus.
Mastoid Foramen.	In or near Occipito-mastoid Suture.	Post. Fossa and Side of Skull.	Emissary Vein.
Carotid Canal.	Apex to Inf. Surface of Petrosal	Mid. Lacerated Foramen and Base of Skull.	Int. Carotid A.
Hiatus Fallopii.	Ant. surface Petrosal.	Mid. Fossa and Aqueductus Fallopii.	Great Superficial Petrosal N.
Hiatus Accessorius.	Ant. surface Petrosal.	Mid. Fossa and Aqueductus Fallopii.	Small Superficial Petrosal N.
Int. Auditory Meatus.	Post. surface Petrosal.	Post. Fossa and Aqueductus Fallopii.	Facial, or 7th Cranial N. Auditory, or 8th Cranial N. Auditory A.

FORAMINA OF THE SKULL (Continued)

NAME.	SITE.	COMMUNICATES BETWEEN.	TRANSMITS.
Aqueductus Vestibuli.	Post. surface Petrosal.	Post. Fossa and Int. Ear.	Ductus Endolymphaticus.
Aqueductus Cochleae.	Inf. surface Petrosal.	Base of Skull and Cochlea.	Emissary V.
Canalis Tympanicus.	Inf. surface Petrosal.	Base of Skull and Int. Ear.	Tympanic branch of the 9th Cranial N. (Jacobson's N.)
Canalis Auricularis.	Inf. surface Petrosal.	Base of the Skull and Int. Ear.	Auricular branch of 10th Cranial N. (Arnold's N.)
Stylo-mastoid Foramen.	Inf. surface Petrosal.	Base of Skull and Aqueductus Fallopii.	Facial, or 7th Cranial N. Stylo-mastoid A.
Auricular Fissure.	Between Mastoid and Tympanic Plate.	Inf. and Ext. surfaces Petrosal.	Arnold's N.
Canalis Musculotubarius.	Parallel and beneath Petro-squamous Suture.	Mid. Ear and Post. Pharynx.	Tensor Tympani M. Eustachian tube.
Canal of Huguier.	Parallel and beneath Petro-squamous Suture.	Mid. Ear and Base of Skull.	Chorda Tympani (br. of 7th N.)
Pterygo-palatine **Canal.**	Inf. surface Sphenoid.	Base of Skull and Spheno-Maxillary Fossa.	Pterygo-palatine A., V. and N.
Optic Foramen.	Between roots of lesser wing of Sphenoid.	Mid. Fossa and Orbit.	Optic, or 2d Cranial N. Ophthalmic A.
Sphenoidal Fissure.	Between wings and body of Sphenoid.	Mid. Fossa and Orbit.	Motor Oculi, or 3d Cranial N. Patheticus, or 4th Cranial N. Ophthalmic Branch of Trifacial, or 5th Cranial N. Abducent, or 6th Cranial N. Orbital br. of Mid. Meningeal A. Recurrent br. of Lachrymal A. Ophthalmic V.
Foramen Rotundum.	Great Wing of Sphenoid.	Mid. Fossa and Spheno-Maxillary Fossa.	Sup. Maxillary br. of Trifacial (5th) Cranial N.
Foramen Ovale.	Great Wing of Sphenoid	Mid. Fossa and Base of Skull.	Inf. Maxillary br. of Trifacial (5th) Cranial N. Motor Root of Trifacial (5th)N. Small Petrosal N. Small Meningeal A.

FORAMINA OF THE SKULL (Continued)

NAME.	SITE.	COMMUNICATES BETWEEN.	TRANSMITS.
Foramen Spinosum.	Great Wing—Sphenoid.	Mid. Fossa and Base of Skull.	Mid. Meningeal A.
Foramen Vesalii.	Great Wing—Sphenoid.	Mid. Fossa and Base of Skull.	Emissary V.
Middle Lacerated Foramen.	Apex of Petrosal.	Mid. Fossa and Base of Skull.	Nothing.
Vidian Canal.	Between Pterygoid process and body of Sphenoid.	Mid. Lacerated Foramen and Spheno-Maxillary Fossa.	Vidian A., V. and N.
Foramen Caecum.	Anterior to Crista Galli.	Ant. Fossa and Nasal Fossa.	Emissary Vein.
Ant. Ethmoidal Canal.	In suture between Horizontal Plate of Frontal and Ethmoid.	Ant. Fossa and Orbit.	Ant. Ethmoidal A., V. Nasal N. (br. of 5th).
Post. Ethmoidal Canal.	In suture between Horizontal Plate of Frontal and Ethmoid.	Ant. Fossa and Orbit.	Post. Ethmoidal A., V.
Parietal Foramen.	Near sagittal suture.	Cranial and Ext. Surfaces.	Emissary Vein.
Infra-orbital Canal.	Below the Orbit.	Between Orbit and Face.	Infra-orbital N. and A.
Ant. Dental Canal.	Within Superior Maxilla.	Infra Orbital Canal and Alveolar Process.	Ant. Sup. Dental N., A. and V.
Post. Dental Foramina.	Tuberosity superior Maxilla.	Zygomatic Fossa and Alveolar Process.	Post. Sup. Dental A., V. and N.
Lachrymal Canal.	Between Lachrymal and Sup. Max. bones.	Orbit and Inf. Meatus.	Lachrymal Duct.
Ant. Palatine Canal.	Back of Central Incisors.	Roof of mouth and Canals of Stenson.	Ant. palatine A. Naso-palatine N.
a. For. of Stenson.	Back of Central Incisors.	Ant. palatine Canal and floor of nose.	Ant. palatine A.
b. For. of Scarpa.	Back of Central Incisors.	Ant. palatine Canal and roof of mouth.	Naso-palatine N.
Large Post. Palatine Canal.	Internal to and behind last molar.	Roof of mouth and Spheno-Maxillary fossa.	Descending Palatine A. Large Post. Palatine N. (Ant. palatine).
Small Post. Palatine Canal.	Internal to and behind last molar.	Roof of mouth and Spheno-Maxillary fossa.	Small Post. Palatine N.

FORAMINA OF THE SKULL (Concluded)

NAME.	SITE.	COMMUNICATES BETWEEN.	TRANSMITS.
Accessory Post. Palatine Canal.	Internal to and behind last molar.	Roof of mouth and Spheno-Maxillary fossa.	Accessory Post. Palatine N.
Spheno-Palatine Foramen	Between Sphenoid and palate bones.	Nasal Fossa and Spheno-Maxillary fossa.	Naso-palatine A. and N.
Spheno-Maxillary Fissure	Floor of Orbit.	Orbit & Spheno-Maxillary fossa.	Sup. Maxillary N. and its orbital branch. Infra Orbital A. and V. Ascending branches from Spheno-Palatine, or Meckel's Ganglion.
Pterygo-Maxillary Fissure.	Between Pterygoid Process and Tuberosity of Maxilla.	Zygomatic Fossa and Spheno-Maxillary fossa.	Branches of Int. Maxillary A.
Malar.	Malar Bone.	Face and Orbit.	Temporo-Malar N.
Mental.	Inf. Maxilla (ext. surf.).	Chin and Inf. Dental Canal.	Mental A., V. and N.
Inf. Dental Canal.	Inf. Maxilla (int. surf.).	Zygomatic Fossa and Alveoli.	Inf. Dental A., V. and N.

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